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The New Telephone Exchange.

RECENT IMPROVEMENTS IN CENTRAL OFFICES —THE NEW MULTIPLE SWITCH BOARD NOW IN USE IN NEW YORK—THE METROPOLITAN TELEGRAPH AND TELEPHONE COMPANY OPEN THEIR NEW EXCHANGE.—EXCELLENT MANAGEMENT.

There seems to be no abatement in the growth of the telephone business in any of its branches, and the apparatus for doing the service expeditiously has steadily improved and kept pace with it.

The Metropolitan Telephone and Telegraph Company, of New York City is under the general management of W. H. Eckert, a modest and unassuming gentleman, who requires no red tape to be seen, and his success is attributed to his quick foresight, business qualities and push. By these tactics he has brought about the most remarkable increase of subscribers to that company, said company only having 2,800 subscribers at his *debut* in August, 1882. They now can proudly point to 4,600 subscribers on their list. He has steadily improved the service with this rapid increase of subscribers.

The service in New York City is second to none in the world. This large system embraces 5,000 aerial wires and fifteen miles of cables, giving a grand total of 3,000 miles of No. 12 wire.

These 4,600 subscribers are grouped into eleven exchanges, which are under the supervision of Chief Operator E. A. Eckert, who has shown his ability in managing the large force of operators required to handle the great bulk of business that is transacted over these 5,000 miles day and night.

Each exchange has its respective manager, who looks after the service of his respective exchange.

This company can put any of their 4,600 subscribers in direct communication with Brooklyn, Jersey City, Hoboken and Newark with an equal number of subscribers, making a grand total of 9,000 telephone subscribers in a radius of fifty miles.

Mr. Seeley, the electrician of this company, has made some marked improvements in the working of the switchboard, whereby connections are made very much quicker, and increasing the facilities of the exchanges. This gentleman has few equals as an electrician in the telephone field to-day.

The Law Telephone Company, whose contract lately expired with the M. T. and T. Co., is a branch of the Metropolitan system, under General Manager W. H. Eckert.

Mr. Childs (formerly general manager of the Law) is retained as manager of the same company.

Their subscribers still continue to use the Law system, and probably will continue to do the same.

General Manager Eckert has just completed building and fitting up a new exchange, with a Western Electric multiple switchboard, which we illustrate to-day. No doubt this is the most rapid work on record, viz., in forty-eight days, connecting up twelve multiple boards with 120,000 electrical connections, and constructing 600 lines, averaging a half mile each, using 300 miles of No. 12 braided wire, and 600 of Gilliland's latest magneto bells.

The orders given for this material were the largest ever given at one time for telephone work.

The construction done was under the immediate supervision of W. A. Vail, general supervisor, and J. A. Seeley, electrician.

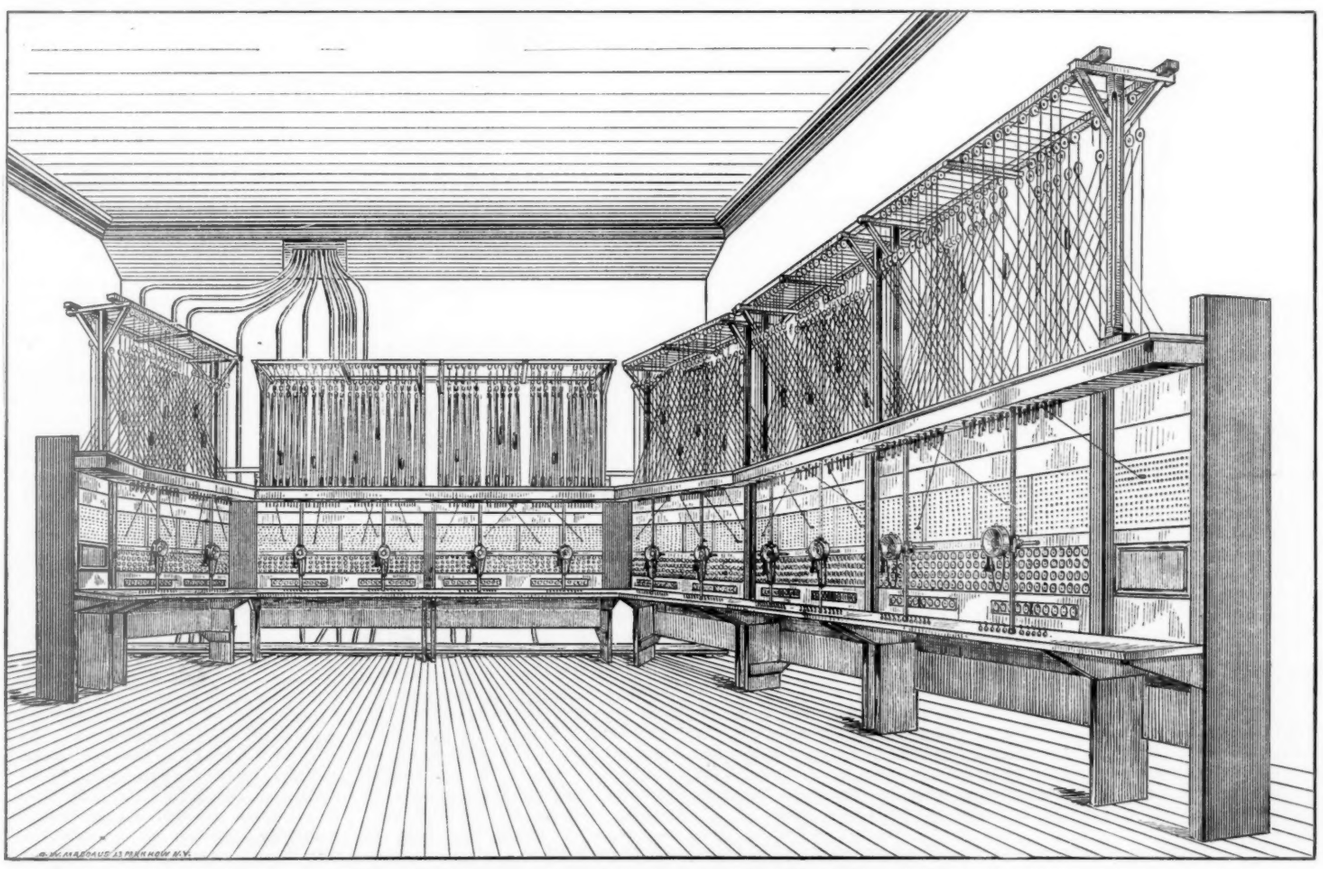
This exchange has been placed under the management of W. E. Lockwood, who made quite a success at the Twenty-first Street Exchange. Mr. Lockwood is a brother of the famous Thos. D. Lockwood, Electrician of the American Bell Telephone Co.

The switchboard recently so expeditiously and perfectly set up in what is called the John Street Exchange of the Metropolitan Telephone Company, in New York city, is the latest form of the multiple switchboard, made by the Western Electric Company.

The capacity of this board was intentionally made small, as the necessary division of work in the city of New York, among several exchanges, renders it unnecessary for any one of them to have such large capacity as some single cities with fewer offices.

This same fact of the necessity for different offices also renders it necessary to make provision for trunk lines, which is one of the special features of the board, as set up in the exchange in New York.

It is expected that there will be 200 trunk lines from the John Street Exchange. These 200 trunk lines are run directly into the multiple system, two sections of spring-jacks being allotted to their use.



THE NEW CENTRAL OFFICE OF THE METROPOLITAN TELEPHONE COMPANY, NEW YORK.

On each board there are twenty trunk line drops and one hundred subscribers' drops.

The excessive rushes of business which sometimes occur in the business part of the day down town renders it necessary to give to one operator only fifty subscribers and ten trunks to attend to.

The system is at present equipped for six hundred subscribers' lines, and one hundred and twenty trunk lines, with capacity for increase to one thousand subscribers' lines, and two hundred trunk lines. There are now six boards, but when the system is completed there will be ten.

At each end of the system there is a special board containing an upright row of spring-jacks, to enable the operator at each end to make connections without reaching across the board.

Care has been taken to make the key-board circuits reliable and at the same time some special features are in use which save a motion for the operator.

The two most important requisites in switchboards for large telephone exchanges are speed and economy.

It so happens that these two requisites go together; for whatever tends to reduce the amount of work to be done, also enables the operators to do it quickly, and therefore diminishes the cost of the work.

The requisites of speed and economy are met with in a high degree in the multiple switchboard.

This system is elaborated from the fundamental idea of having each operator reach all the subscribers' lines in an exchange with one motion for each line, and of having each operator do all the work involved in effecting the connecting and disconnecting of two subscribers. There is no repeating of orders, either by word of mouth or by tickets.

An operator has a certain number of subscribers whose calls she answers. When one of these subscribers has called for a connection with any other subscriber of the exchange, the operator who takes the order makes the connection of the two lines instantly and rings the bell of the subscriber wanted.

When the conversation is finished, the same operator who connected them together receives the notice by the subscribers to disconnect, and then disconnects the lines. This is all done by the operator without moving more than a step.

It is hard to imagine a system more simple or more easily manipulated. It is in consequence of its simplicity that it is so economical.

One switchboard of the multiple system is composed of—

1st. A certain number of spring-jacks, one for each line centering at the exchange.

2d. A number of annunciator drops. Two hundred is the number now commonly agreed upon as suitable for one board. Two operators are expected ordinarily to do all the work for two hundred subscribers.

3d. A number of pairs of connecting cords, each with suitable keys and connections for the operators' telephone, the apparatus for ringing subscribers' bells, and the clearing-out drops.

As many switchboards are required in an exchange as there are times two hundred subscribers. For instance, with one thousand subscribers, five switch boards would be necessary.

Several different arrangements of the spring-jacks and annunciators, with reference to their disposition on the board, have been tried.

The annunciators have been placed all above the spring-jacks, all at the two sides, and part above and part at the two sides.

None of these arrangements, however, seem to possess the advantages which are secured when the annunciators are placed across the boards below the spring-jacks, with the operators' key-board below the annunciators, and the shelf for holding the cords and pulleys above the spring-jacks.

One important advantage of this general arrangement is that it allows the placing of the boards together, end to end, thus enabling an operator at any board to make connections between the spring-jacks upon her own board and those upon the adjacent board, in cases where those spring-jacks are nearer than the corresponding ones upon her own board.

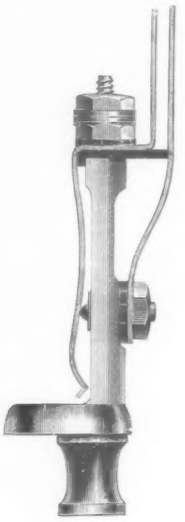


Fig. 1.

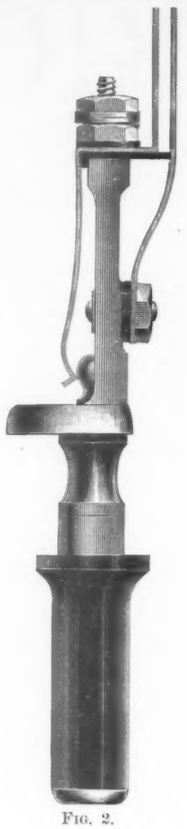


Fig. 2.

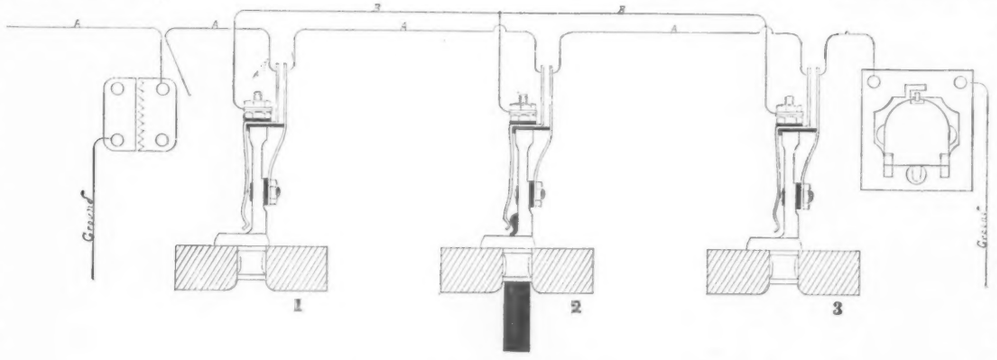


Fig. 3, Spring-Jack Connections.

For example, the operator at one end of board No. 2 is enabled by this arrangement to make connection directly with the spring-jacks on board No. 1, where they are more readily reached than are the duplicates on her own board; or the operator at the other end of board No. 2 may make connection with the spring-jacks at board No. 3, where it can be done more quickly and easily.

This principle may be carried to the extent of placing a half section of board at each end of the system of multiple boards, thus giving the operators at the beginning of the first board and at the end of the last board the same advantage in this respect.

The spring-jacks are mounted on bases, each containing one hundred. Each of these sections of one hundred spring-jacks occupies a space of five by fifteen inches. They are ranged across the board, and space is left above for adding new rows of these sections, as the growth of the exchange shall require.

The shelf from which the cords are suspended is made movable, so that when new rows of spring-jacks are added, the shelf may be raised out of their way.

The annunciators are the same as have been used for several years with their standard switch boards. They are furnished in sections of five drops each or any multiple of five.

When a plug is inserted into the jack, the phosphor-bronze spring is lifted from the insulated contact point, breaking a connection therefrom, and a new connection is established to the tip of the inserted plug upon which the spring now rests, and thence to the cord connecting with the plug. *See Fig.* 2.

A connection, or *cross*, is also established between the phosphor-bronze spring and the frame of the jack, through the medium of the plug. It is this cross as thus established (and which is more fully described hereafter) which provides for the operator's test.

The spring-jack used with the multiple switch-board system is the same as the one for several years used with our standard switchboard, with one exception, that of an insulation established between the frame of the jack and the spring which forms the usual line connection.

This insulation becomes necessary in the multiple system to provide for the test which enables the operator to determine whether the line is in use.

The accompanying cut (*Fig.* 1) shows the jack as used on the multiple board. The frame of the jack is inserted at the back of the board and screwed fast by a lug which forms a portion of the frame.

The phosphor-bronze spring, and the contact point upon which it normally rests, are insulated from the frame of the jack by hard rubber bushings and plates.

The connections of the jacks are all made at the back of the board, and, to facilitate this work, phosphor-bronze connecting pieces are extended from both the insulated contact point and spring, bringing all the connecting points together in one plane surface.

The accompanying diagram of circuits shows three spring-jacks of a line placed respectively on three multiple switch boards.

The circuit through these three jacks and the annunciator is from the subscriber's line through the lightning arrester to the spring of the first jack; from the contact point upon which this spring rests to the spring of the second jack; from the contact point upon which the second spring rests to the spring of the third jack; and from the contact point upon which this last spring rests the circuit is through the annunciator belonging to that line, and thence to ground.

As is evident, the annunciator may be placed at any of three boards, but at whichever board it is placed, its magnet must be included in the circuit between the last spring-jack and the ground.

The springs and contact points included in this circuit being, as above described, insulated from the frames of the jacks by hard rubber, no connection exists between the line circuit and the frame of any jack during its normal condition—that is when not in use.

The frames of the three jacks are all connected together, but normally to nothing else.

The line circuit through the system, as shown in the diagram, is lettered *A*. The wire which serves to connect together the frames of the jacks is lettered *B*.

The insertion of a plug at any one of the three jacks, as shown at the second jack, lifts the phosphor-bronze spring free from the contact point upon which it normally rests, thus disconnecting the annunciator and ground, and establishing connection between the line and the cord connecting with the plug, as well as the cross connection between the line and the frame of the jack.

The frames of all the jacks of the same number being connected together, are consequently all crossed with the line.

An operator at any other board may therefore determine the fact of a cross between the jack frames and the line by touching the frame of the jack at the front of the board with the plug which she is about to insert into the jack to complete a connection.

Electric Light in Cars.

Recent experiments in illuminating railway trains in the United Kingdom with the incandescent electric lamp have proved very successful. So much so has this been the case that the one company on which the new light was tried (the London, Brighton and South Coast) will use the system to the exclusion of all others. The *Daily News* says the system employed is a combination of dynamo machines and accumulators. When the train was in motion the electricity was stored and given out as required. Thirty twenty-candle incandescent lamps were used. The apparatus was entirely under the control of the "front guard," who, by means of a handle, turned the current on and off at pleasure. For example, while the train was running in broad daylight the electric light was not used, but the moment a tunnel was entered it was employed to a great advantage. The electricity was generated by means of a belt connecting the dynamo machine with the axle of one of the wheels. The system is the invention of Mr. Stroudley, of Brighton (locomotive department), and Mr. Edward Houghton, the superintendent of the telegraph department. It is said to be "much cheaper than gas and only a little dearer than oil."

TELEGRAPHIC

The Delany Synchronous-Multiplex System of Telegraphy.

A new system of telegraphy has recently been invented by Mr. Patrick B. Delany of the city of New York, that is apparently destined to revolutionize the various existing systems of telegraphic communication. As its name indicates, the synchronous-multiplex system is based on the synchronous rotation of two arms which represent the ends of the wire placed, one at each end of the line. The synchronism of these arms is automatically maintained by electrical impulses, sent over the line by one of the arms when it varies in speed of rotation slightly from the other. So thoroughly has the inventor been enabled to control the speed of either arm by the position of the other that it is possible to maintain for weeks at a time, the same in rotation at stations hundreds of miles apart, without either arm varying in speed the one six-hundredth part of a second.

Those who are but partially acquainted with the details of telegraphic communication will readily appreciate the unusual importance of any means by which the synchronous rotation or movement of widely separated instruments can be maintained. Many have striven for it, but in vain, until now, when, as it appears, a complete solution of the problem has been found.

The electrical possibilities that result from the maintenance of synchronism are very great and promise much for the world's future. In no direction are these possibilities so directly evident as in the field of telegraphic communication. Before pointing out the various ingenious devices employed by the inventor for the maintenance of synchronism, it may be well to explain some of the advantages it offers over the ordinary telegraphic systems.

The duplex and the quadruplex systems of telegraphy have justly been regarded as triumphs of electrical skill. By this means two and four messages, respectively, can be simultaneously transmitted over a single wire, and not only so, but these messages can be transmitted in opposite directions. What then shall we say of the inventive skill that will permit seventy-two telegraphic messages to be simultaneously transmitted over a single wire? For this is one of the results of the application of the synchronous system to magneto-electric telegraphy.

A peculiarity of the synchronous-multiplex system that distinguishes it from the quadruplex system, lies in the fact that any number of the seventy-two messages referred to, can be sent in one direction, and the remainder in the opposite direction; or all may be sent in the same direction. In the quadruplex system, on the contrary, two messages only can be sent in the same direction. In times of great public excitement, when the great bulk of telegraphic business may for awhile be in one and the same direction, the advantage of this peculiarity of the synchronous system, as great lines, will, in time, be readily appreciated.

Perhaps, however, one of the most valuable features of the synchronous-multiplex system lies in the fact that its introduction will render the employment of private telegraphic lines much commoner than has hitherto been practicable. The extended use of long distance private wires, as per example between far distant cities, has been prevented to a great extent by the excessive cost. Now, however, that this cost can be divided between, say seventy-two subscribers at each end of the line, or one hundred and forty-four in all, the great reduction so effected will bring private lines within the reach of nearly all whose business requires such assistance.

The marvellous growth of the telephone is readily understood when we remember the very extended facilities it offers for the transactions of ordinary business. By its use, the inhabitants of a large city, or even of neighboring cities, are brought into the closest business relations, and to a certain extent both time and distance are annihilated. Its introduction by any one in a particular line of trade, gives him such advantages over others in similar lines of trade, that it is no longer optional with them whether they will use the instrument or not; they either must use them or suffer materially by competition.

The advantages thus gained for comparatively short distances have been so great that a constant endeavor has been made to extend the use of the telephone to great distances. The difficulties, however, in the way of successful long-distance telephony have been too great, thus far, to permit any very general use of the same. It is apparently in this direction that the greatest use for the multiplex telegraphic system will be found. It alone is capable of doing for the inhabitants of the most widely separated cities exactly what the telephone is now doing for shorter distances. And it requires no very deep insight into the future to be able to predict that its successful limited introduction between any two distant cities will necessitate its general introduction on as extended a scale as that we have witnessed in the case of the telephone; since the increased business facilities gained by its use will force others to adopt it, provided only its cost is not expensive. Extended telegraphic communications thus established, binding all portions of a continent together, cannot fail to have a great influence on the world's progress.

Another peculiarity of the synchronous-multiplex system that may possibly render it a dangerous rival of the telephone, lies in the fact that when printing circuits are employed, a permanent record of all business transacted is preserved, which is a desideratum long sought for in the case of the telephone, but sought for in vain. It may be mentioned here, that the use of manipulating one of these printing circuits is quite simple; any one who can spell out the message can send it, and merely the ability to read is required for its reception, since the message is received and recorded in printed characters on a slip of paper, in a manner similar to well known printing telegraphic instruments used by the brokers.

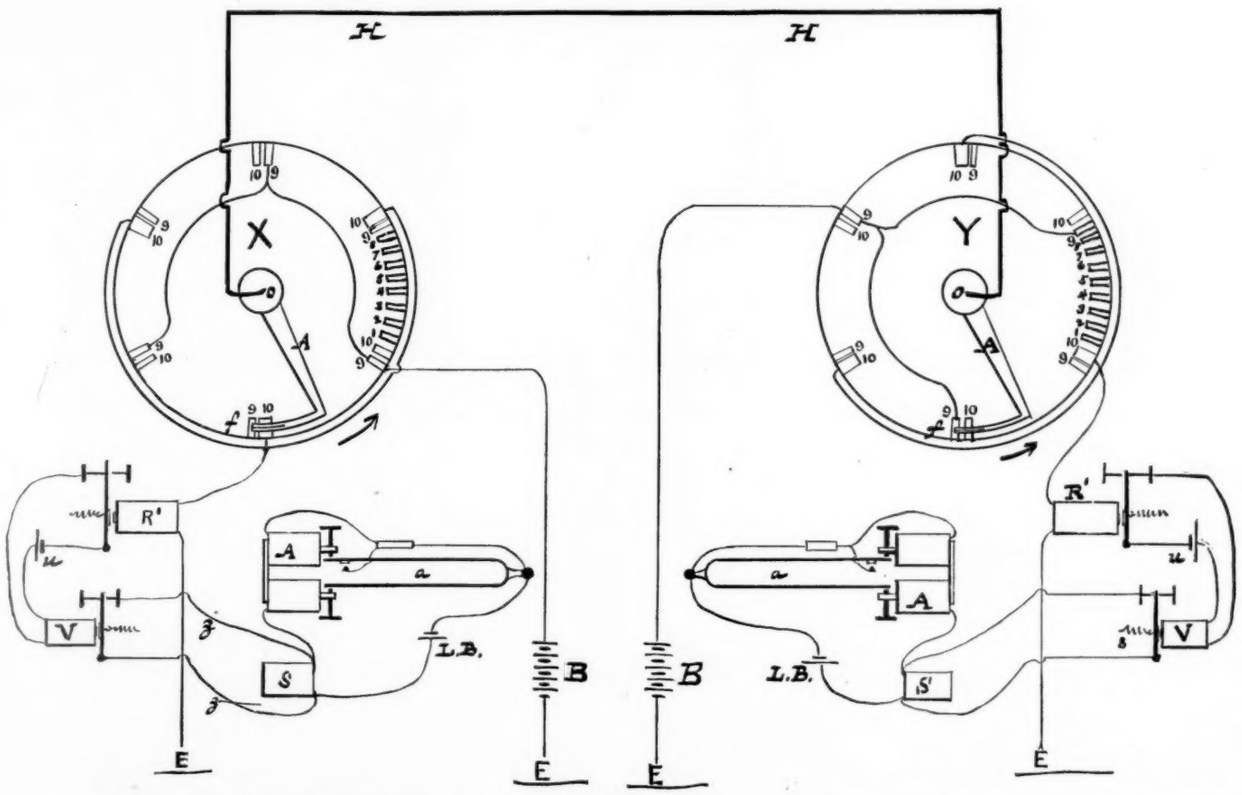
When, in addition to these advantages of the multiplex system, we add that its introduction means the establishment of private lines, the entire and free use of which is always ready for the subscribers employing it, and that the vexatious delays resulting from the use of the line by others, so common in telephonic exchange systems, is entirely avoided, the great value of the multiplex system will, perhaps, be more clearly appreciated.

Having thus briefly sketched some of the more important advantages of the multiplex-synchronous system of telegraphy, we will now proceed to a detailed description of the various apparatus by means of which the existence of the system has been rendered possible.

As already briefly stated, the system is based on the synchronous rotation of two arms placed one at each end of the line. These arms are shown at *X* and *Y* respectively, in Fig. 1, and are electrically connected by the single wire *H H*, which may be of any length, such, for example, as if the stations at *X* and *Y* were Boston and Chicago, respectively. On the face of a circular circuit table, and arranged concentrically to each of the arms, are placed series of insulated contact pieces, numbered from one to ten, consecutively. For the sake of clearness, only one of these series is shown complete. The contacts, from one to eight, inclusive, are used for the establishment of separate and distinct circuits at each end of the line. The line, therefore, as shown in this figure, may be employed for the establishing of forty-eight separate circuits, since there are six sets of eight contacts each, or, the 1's contacts in each of the separate groups may be connected together for one circuit; the 2's contacts may be similarly connected for another circuit, and in the same manner the 3's, the 4's, and so on up to the 8's. Of course any other division of the circumference of the circuit table could be made, and the division of the line *H H* into separate circuits thus varied at will, within certain wide limits.

The terminals of the main line *H H*, are suitably connected to the swinging arms *A A*, provided with trailing fingers *f. f.*, and the whole so arranged that as the arms are rotated the insulated contact pieces are success-

Fig. 1.



ively brought into electrical connection with the main line.

With each of these insulated contact pieces, except the 9's and the 10's, or with the respective group thereof, as already explained, are connected suitable transmitting and receiving instruments. Such an arrangement is shown in Fig. 2, where twelve groups of contact pieces are shown, and the contacts corresponding to the 1's in each group are represented as connected together; the remaining contacts being omitted for the sake of clearness.

At each station, *X* and *Y*, a battery *B*, split and grounded in the middle, is connected, as shown, to an ordinary telegraphic key and polarized relay *R*, and to corresponding numbered contacts in the circle. In this case, shown in Fig. 2, the connection is made to the group of 1's contacts. Should now the arms *X* and *Y* be rotated with a synchronous movement, at each time the trailing fingers *f, f*, are brought into contact with the No. 1 contacts, the operators connected to the instruments at *S* and *S* respectively, will be brought into electrical communication with each other. When the switch *S'* is placed as at *Y*, the operator is ready for receiving, but when placed as at *X*, he is ready for transmitting. If now similar sets of instruments are connected with the corresponding group of contacts for the 2's, the 3's, the 4's, and so on up to the 8's, eight distinct and separate lines of telegraphic communication will be established over the wires *H H*, between the two stations *X* and *Y*. The success of such a system is, of course, dependent on absolute synchronism being maintained between the two arms at *X* and *Y*, since it is evident the trailing fingers *f, f*, must of necessity be on the 1's contacts at station *X*, at the same moment they are on the 1's contacts at station *Y*, and so for the other contacts.

Since it is evident that the corresponding sets of operators at either end of the line are alternatively placed in communication with one another through the main line *H H*, and alternately cut out of communication with each other during the time that the trailing fingers are resting on other contacts, it is necessary to explain why there is no sensible interruption in the practical continuity of the separate circuits. Briefly stated, the reason is very simple. They follow one another with such rapidity, that before any of the operators can possibly realize that the line has been taken from him and given to another operator, it is again given back to him, so that he has the line at his command to the same extent as if he alone were using it, and this up to the most rapid rate of manipulation. Since by this method the line is given successively to the various operators connected therewith, it is evident that the messages can be sent in any direction either from *X* to *Y*, or from *Y* to *X*, by moving the switches *S' S'*, and that all of these messages may be sent in the same direction, or any number in one direction, and the remainder in the opposite direction.

In the case shown in connection with Fig. 2, the operation at *X* and *Y*, connected with the number, contacts would be brought into electrical connection with each other, or with main line, *H, H*, twelve times for each rotation of the arms. If then these were rotated at the rate of, say of two and five-sixths times per second, a rate found very convenient in actual practice, there would be given to each group of contacts thirty-four electrical connections with the main line per second, a rate that for all practical purposes is equivalent to a continuous connection therewith.

We may place in the circuit so provided any electrical device dependent for their operation on the passage of an electrical current. There is shown in Fig. 2 polarized relay suitable for use in connection with the ordinary Morse telegraphic instruments, with the degree of division here shown, the circuit will permit the most rapid rate of manipulation of the key possible by the most skillful operator. With a higher rate of division—as, for example, sixteen—the ordinary Morse characters may still be sent, though necessarily at a somewhat slower rate of speed. For circuits higher than, say twenty-four, it is preferable, at the present development of the system, to employ printing telegraphs, the advantages of which on private lines are manifest, since they insure economy, by dispensing with the services of the skilled operator and secrecy, by enabling the communication to be sent directly by the interested parties, without the intervention of outsiders.

FIG. 2.

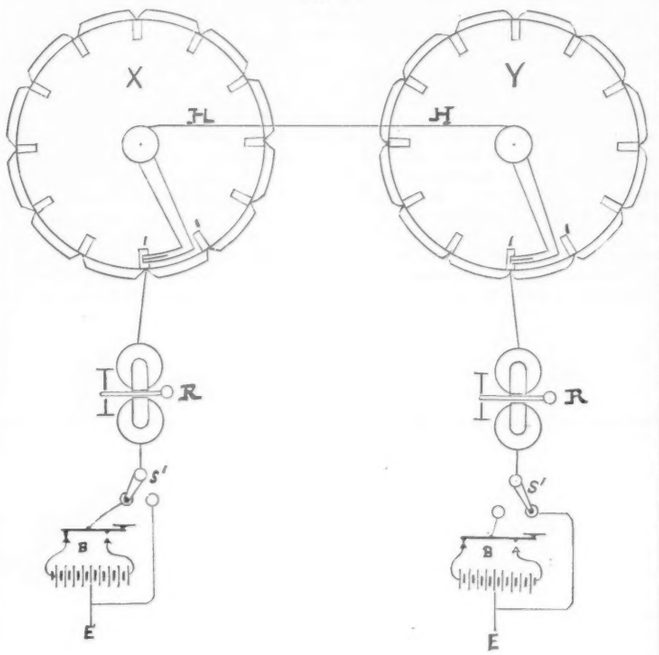
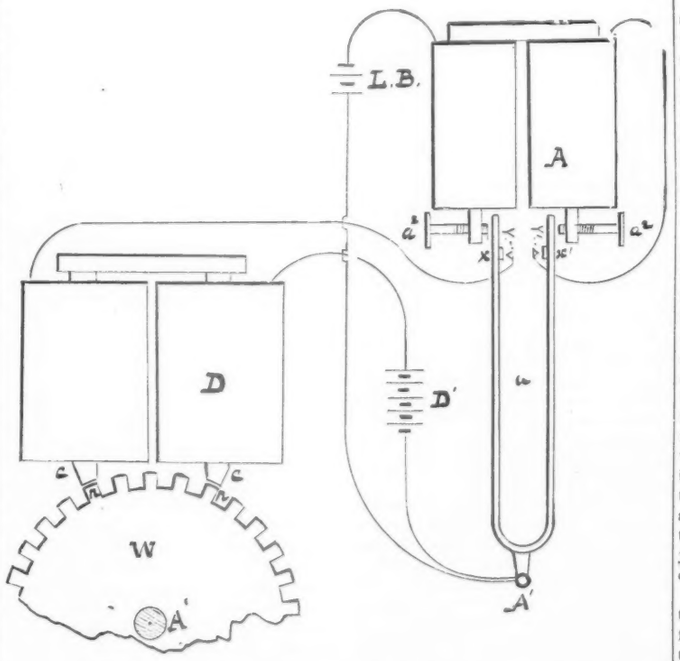


Fig 3



Since the circuit is made and broken some thirty-four times per second in the case above described, each of the ordinary Morse characters sent into the line must be made up of more than a single contact, varying in number with the length of the character. The ordinary Morse relay is not adapted for the reception of these characters, since such a relay would record each of these numerous makes and breaks.

The inevitable confusion that would thus be introduced is avoided in practice by the employment of a polarized relay that responds, not to the mere pulsations caused by the successive makes and breaks, but to changes in polarity only, caused by the connection of the split battery, *B B*, to the polarized relay. By this means the armatures of the polarized relays remain in the position that the lost current has placed them, until their position is changed by the reversal of the current, notwithstanding that the finer vibrations comprised in these reversals are continuously passing through the magnet of the polarized relay, but are not manifested in its armature. This addition to the system has been invented by Mr. E. A. Calahan, the inventor of the gold and stock printing telegraph, and of the American District Telegraph system, who has been associated with Mr. Delany from the beginning of his investigation of the subject.

The mechanism for the rotation of the disks, to which the arms are attached, at each end of the main line, is shown in Fig. 3, and is based on an invention of a Dane, named La Cour, and termed by him a phonic wheel. Briefly stated, this wheel, shown in the figure at *W*, has its teeth, *r r*, of magnetic material, and is maintained in rotation by the action of a battery current, *D'*, pulsated through the coils of the electro-magnet, *D*, by the vibration of a tuning fork, *a*.

The fork, *a*, is furnished with contacts, *x* and *x'*, on its opposite lines. When set into vibration, these contacts make and break circuits connected respectively with suitably-supported contact pieces, *y, y'*. Two such circuits are shown in the figure, viz., that connected with the contacts, *x* and *y*, which include the battery, *D'* and the electro-magnet, *D*, and that connected with *x* and *y'*, which include the local battery, *L B*, and the electro-magnet, *A*. The latter circuit is provided for maintaining the vibration of the fork, *a*, which it does by the action of the electro-magnet, *A*, in a manner similar to the action of the well-known alarm bell. The latter circuit is provided for the rotation of the phonic wheel, *W*, under the influence of the battery current, *D'*, pulsated in the coils of the electro-magnet, *D*, by the vibration of the fork. This it does by the magnetic attraction exerted between the pole-piece, *c c*, of the electro-magnet, *D*, and the magnetic teeth, *r r*, of the phonic wheel. Under the influence of the vibration of the pole, the pole-piece, *c c*, are alternately magnetized and demagnetized, so that if a rotation be imparted to the wheel, *W*, it will be maintained in rotation with a speed dependent on the rate of vibration of the fork, *a*.

The arms at the ends of the main line, that we have already referred to, are suitably connected to the axis, *A'*, of the phonic wheel, and rotate into it, so that as it turns the trailing arms, *A A*, with their contact fingers, *f f*, are moved successively over the insulated contact piece, placed on the upper face of the circuit tables. Since the speed of rotation of the arms is dependent solely on the rapidity of vibration of the forks, in order to maintain the sychronous movements of the distributing arms, it is only necessary to maintain the synchronous vibration of the forks.

The problem, however, of maintaining absolute the synchronous vibration of two widely separate tuning forks is by no means a simple one. So many circumstances may cause their rate of vibration to slightly vary, that previous to Mr. Delany's invention the problem has never been solved; indeed, the difficulties in the way have been confessedly so great that in the opinion of many the problem was deemed insoluble. Mr. Delany, however, has given the world a solution that is both ingenious and simple.

An inspection of Fig. 1 will show the means whereby the synchronous rotation of the disks is maintained. In this figure, the 9's and 10's contacts, which are reserved for the synchronizing of the apparatus, are alone shown. At station *X*, three of the 9's that are furthest apart, that is, those three that are 120° distant from each other, are connected together and to a battery, *B*, one pole of which is grounded. The 10's contacts adjoining these battery-connected 9's are left open or unconnected with any apparatus. Three 10's, intermediate to the battery-connected 9's, and therefore also 120° distant from each other, are connected together and to the ground, *E*, through the relay magnet, *R'*. The 9's adjoining these connected 10's, are also left open or unconnected to any apparatus.

At station *Y*, three of the 9's that are furthest apart, that is, three that are 120° distant from each other, are connected together and to the battery, *B*, one pole of which is grounded at *E*. The 10's adjoining thereto are left open, or are not connected with any apparatus. The three intermediate 10's are connected together and to the earth, *E*, through the relay, *R*, and the 9's adjacent thereto are left unconnected or open. It will be observed, however, from an inspection of the figure that the battery-connected 9's at station *X* correspond in position to the unconnected 9's at station *Y*, and also that the relay-connected 10's at *X* correspond to the unconnected 10's at *Y*.

It will be noticed from an examination of Fig. 1, that the 10's segments that are connected to the correcting devices at *R' R'*, at

each station, are built out or extended towards the unconnected 9's, and are consequently wider than the rest of the contact pieces.

As shown in Fig. 1, the two arms are represented in similar positions; that is, they are supposed to be in synchronism, and in this position it will be noticed that the trailing figure *f*, at station *X*, rests on an unconnected 9, while that of station *Y* rests on a battery-connected 9. No current, therefore, flows from the battery *B*, at *Y*, since the circuit is open at *X*. Should, however, the arm at *X* gain slightly on that at *Y* sufficiently to permit the trailing arm at *A* to touch the contact 10, while that at *Y* is on a battery-connected 9, then the circuit of the battery *B*, at *Y*, will be completed through the main line, *H*, *H*, the contact 10, and relay *R'*, at *X*, through the ground. An electrical impulse, therefore, will be sent out from *Y* to *X*, which, flowing through the relay *R'*, at *X*, will cause its armature to be drawn from its back stop, thereby breaking the local circuit *u*, and permitting the armature of the electro-magnet *V* to move rapidly to its back stop. By this means a shunt circuit, *z*, *z*, is completed around the resistance, *S*, whereby the said resistance is cut out of the local circuit. *L*, *B*, of the fork, *a*.

Now, since the current that flows in any circuit is dependent on the resistance in such circuit, the action of the current sent into *R'*, at *X*, from *Y*, must result in an increase in the strength of the current traversing the coils of the vibrator-magnet, *A*. This increase in the magnetism of *A*, so caused, produces an increase in the amplitude of the fork's vibration, and a consequent decrease in the rate of its vibration; for, although the duration of oscillation of a fork is sensibly equal for all amplitudes, provided these amplitudes be small, it is not equal when the amplitude is great. The sudden increase of current strength, therefore, consequent on the cutting out of the resistance, *S* from the fork's circuit, shows the fork, *a*, and consequently the rotation of the disk at *X*, and causes its trailing finger, *f*, to drop back on the open or unconnected 9.

Similarly, if the disk at *Y* should gain on that at *X*, an impulse would be sent out from *X*, which would result in showing the trailing finger at *X*, until it came into synchronism with that at *Y*.

The impulses sent out from either station in the manner we have just described are retarding ones, and are sent over the lines at such times only as one disk or arm gains slightly on the other. Mr. Delany has invented various devices by which similar retardations are obtained, and has also devised combinations by which the electric impulses are made accelerating in their character, and are, therefore, sent out at such times only as one disk slows or loses on the other.

The idea of sending absolute impulses over the line at such times only as they are needed—that is, of causing these impulses to be sent only when one wheel or arm slightly gains or loses on the other—is an exceedingly happy one, and the ingenious devices that are employed to accomplish it are so successful in practice that, as we have already said, the two disks can be maintained in rotation at stations hundreds of miles apart without the speed of one varying from that of the other by the one six-hundredth part of a second, or the one-hundredth part of an inch.

Since the regulating devices that maintain the synchronism are entirely automatic in their operation, the apparatus once started needs no attention on the part of the operators in the main offices at each end of the line. In this respect, the synchronous multiplex system is far less complicated in its operation than the well-known quadruplex system, which, as is well known, is based on the differential method, or on the balancing of resistances, and which will not operate if the resistances are but slightly thrown out of balance. In the quadruplex system a variation of the resistance, corresponding to an increase in the length of the circuit of ten miles, suffices to throw the line out of working order. In the synchronous multiplex system, on the contrary, a variation in the resistance of line, equivalent to an increase or decrease of two or three hundred miles, can be instantly thrown into the line without affecting the synchronism, and consequently the operation, of the line.

It is necessary, in the synchronous multiplex system, where long lines are employed, to rid the line of the strong static charge that will almost invariably be found on it. That is to say, where a considerable length of line exists between the two stations, after the line is taken away from one operator, before it is given to another, it must be completely freed of its charge. This the inventor accomplishes by the placing of additional contact pieces on the surface of the circuit tables, between each of the separate contact pieces that we have described as being placed on the tables in groups, numbered from one to ten consecutively. These additional or discharge contacts are well connected together and to the ground, so that the line is always put to ground, after it is taken from one operator, before it is given to the next, and its complete discharge is thus secured.

The discharge contacts that we have described as being placed between each of the separate contact pieces on the circuit tables before the expanded 10's, in order to provide space for the increased breadth of the expanded 10's. Since the 9's, preceding the expanded 10's, and corresponding in position to the battery-connected 9's, are open or disconnected with any apparatus, and since the stated discharge contacts between the battery connected 9's and the open 10's, at the distant station are retained, no bad results are experienced.

In starting the apparatus, the fork, *a*, is put mechanically into vibration, and the disk with its boiling contacts rotated. As soon as a speed is obtained for it, corresponding to the rapidity with which the fork is vibrating, its rotation will be maintained by the intermittent impulses sent through its magnet coils. As soon as this is accomplished, the operator at the other station starts his apparatus, and closing his switch at *S'* (Fig. 2), completes the proper adjustment of the ten instruments. When he hears the click of the relay at *R'*, he knows that a connecting impulse has been received from *X*, and then proceeds to adjust his apparatus until synchronism is obtained between it and that at the distant station. This adjustment is approximately effected by turning the screws in the core ends of magnet *A*, closer to or further away from the fork. The automatic correcting impulses then regulate the vibrations of the fork. In practice this operation is generally completed in a few moments.

Of course the rapidity of transmission of any telegraphic dispatch will necessarily be diminished in proportion to the extent of division of the line. This decrease, however, is far less than might be supposed. With six telegraphic circuits, for example, with the Morse characters, and a speed of revolution furnishing thirty-four contacts per second, the most rapid rate of transmission advisable by the most expert operator is practicable: with twelve Morse circuits, a rate of transmission can be employed, as rapid as that ordinarily used by the average operator. The limit, however, of twelve Morse circuits must not be regarded as final, since higher rates of rotation, and the introduction of contemplated improvements will, it is believed, greatly increase the rate of transmission.

But it is in the employment of printing circuits that the synchronous-multiplex system finds, for the present, its most evident application. There have, as already, mentioned, been successfully applied to a line as many as seventy-two distinct printing circuits.

Though the rate of transmission, in this case, is of course necessarily decreased, yet it is possible, by its employment, to transmit during the business portion of the day, say from 10 A. M. to 4 P. M. as many as one hundred telegraphic dispatches of the ordinary length; an amount equal to ordinary business requirements, and in excess of the rate of service that could be reasonably expected from any of the telegraphic companies on which the general public are now dependent.

The advantages attending the use of printing instrument, arising from dispensing with the services of the skilled telegraphic operators, and the secrecy resulting from the interested parties alone sending and receiving the messages, when coupled with the time saved by always having the line ready for the business of the persons using it, are so great that the above slight decrease in the rate of transmission will, we think, be more than counterbalanced.

In the case of the ordinary telephone service, between any ten important points, as for example, between ten large cities, a subscriber who could obtain the uninterrupted use of the line for the transmission of one hundred telegraphic dispatches, during the business portion of the day, would certainly be more than ordinarily surprised. When we add to this the certainty of no outside parties intercepting his business, and a permanent printed record of all business sent or received being obtained, the advantages of the use of printing circuits will be evident.

Of course, it will be readily understood that the synchronous-multiplex message is absolutely secret. Unlike other systems, its line cannot be privately tapped and the message intercepted, since an ordinary instrument placed in the line would receive in a perfectly unintelligible form, not only all the signals transmitted by each of the separate circuits then in use, but as well each of the separate makes and breaks in the continuity of the line circuit as it is successively transferred from one operator to another, and these signals would be so transposed and altered that, even if the instrument could record them, they would be as devoid of intelligent connection as would a form of type, casually set for numerous messages, when dropped through successive series from a height to the ground. We feel sure that this feature of the synchronous system cannot fail to commend itself to the general public.

The successful introduction of the synchronous-multiplex system will, we are assured, revolutionize the present system of telegraphy, and win for its inventor a world-wide reputation. EDWIN J. HOUSTON.

Central High School, Dec. 31, 1883.

[We regret that this excellent article has been unavoidably crowded out since above date.]—ED.

The telegraph line between Jicotencatl and Tampico, Vera Cruz, has been opened to the public.

Telegraphy will be taught in the Children's School, the coming year, says *La Epoca*, Mexico.

A telegraph operator has been assassinated in Ozuluama, State of Vera Cruz, Mexico, by unknown parties.

Telegraphy in Japan.

According to a statement in the *Times*, given on the authority of the Japanese Embassy in London, there are 4,733 miles of telegraph (12,470 miles of wire) in Japan, the number of telegrams despatched in 1882 being 2,784,287.

The New Telegraph Companies.

The Board of Trade Telegraph line, from Chicago to St Louis, and the Pacific Mutual Telegraph line, from St. Louis to Kansas City, were purchased on the 30th ult., by the Bankers' and Merchants' Telegraph Company of New York. Both are four-wire lines.

Rival Telegraph Companies.

Vice-President Van Horne, of the Western Union Telegraph Company, was shown a statement made by Mr. Robert Garrett, of the Baltimore and Ohio Company, to the effect that the Western Union "had too heavy a load to carry."

"Well," Mr. Van Horne said, "we are willing to make comparisons with the Baltimore and Ohio people. For instance, on the basis of pole line, Western Union has 150,000 miles, and Nickel Plate and West Shore have 950 miles. Now, 950 miles, at $800,000, is $824 per mile. Western Union's 150,000 miles, at $842 per mile, would be $126,300,000. On the basis of wire Nickel Plate and West Shore have four wires, each 950 miles long, making a total of 3,800 miles, Western Union's miles of wire are about 450,000; Nickel Plate, 3,800 miles, at $800,000, would be $210 per mile; Western Union, 450,000 miles, at $210 per mile, would be $94,500,000."

After having prepared the above figures with great care, Mr. Van Horne added: "It appears, therefore, that the Western Union Company's wire lines would be worth, on the basis of the price paid by the Baltimore and Ohio people for the Nickel Plate and West Shore lines, about $94,500,000, and the Western Union Company's pole line would be worth, on the Garrett basis, about $126,300,000."

Two New Cables to be Laid.

THE OFFICERS OF THE MERCHANTS' COMPANY AND ITS PLANS.

The Merchants' Telegraph and Cable Company met on Friday last to perfect an organization, the following directors being present: The Hon. Thomas L. James, Anderson Fowler, M. D., C. Borden, E. A. Quintard, David Bingham, W. A. Cole, E. R. Livermore, Henry W. O. Dodge, A. D. Straus, John H. Herbert, Henry O. Eyde, George F. Plummer, Edward A. Tobey, and Vernon H. Brown. Officers were elected as follows: President—Thomas L. James; Vice President—Anderson Fowler; Treasurer—E. R. Livermore; Secretary—Amos Rogers. Counsel—Wayne MacVeagh. Executive Committee—A. D. Straus, Henry O. Eyde, John F. Plummer, E. A. Quintard, and W. A. Cole. Finance Committee—David Bingham, Anderson Fowler, and E. R. Livermore.

The new company proposes to push forward the work of laying two cables between New York and London direct. The cables are to cost less than any of those that have been previously laid across the Atlantic, and are known as "light cables." They will be constructed differently from those now in use, in that the outside wrappings of hemp are to be twisted in such a manner as to prevent any injury in the paying out. The iron armor or covering of the present cable will also be dispensed with in the deep sea, and only used when the ocean currents are strong and near the shore, where the wear and tear of tide and storm is liable to injure the cables. The composition, with the hemp that forms the outer covering, has been found to be impervious to the action of the sea water. The two cables will cost $6,000,000, and they are to be constructed within a year. Over 85 per cent. of the cable business is said to emanate from this city, and by far the larger portion of this is of a business nature, of which the new company hopes to obtain a large portion, as its object is to furnish a trustworthy business cable.

When the electric light was first introduced several mill owners put it into their mills, some of whom found it impossible to use it, as the tremor of the mill made it unsteady. Since the machines have been further perfected, however, this trouble has been overcome, and now the mills are numerous that are lighted by electricity. It is of direct benefit to the mills that are run nights, as it enables better work to be done than can possibly be turned out by light that is less bright. It also lessens the risk from fire, as as there are no lamps that can be upset.

Mr. L. Y. Cowl has lately been appointed superintendent of the Sperry Electric Light Company, Chicago.

The Pennsylvania company's depot, in Chicago, one of the finest in the world, is to be illuminated by ninety-five (95) electric lights.

Telephonic News

The Central Union Telephone Company, of Chicago, and the Iowa and Minnesota Telephone Company, of Cedar Rapids, have both declared quarterly dividends of 1½ per cent.

At Xenia, Ohio, the destruction of the Union Block, by fire, resulted in considerable damage to the telephone exchange from water.

NEW YORK.—The Universal Telephone Company filed its certificate of incorporation on the 30th ult. The capital stock is fixed at $2,500,000. Edson L. Smith, Amos G. Cleckner, and William T. Brown are the corporators.

The New York and New Jersey Telephone Company, with a capital of $2,400,000, paying 1½ quarterly dividends to 437 stockholders, and operating upon Long Island and in the territory about Jersey City, reports for fifteen months ending December 31, 1883, receipts of $306,899 and net earnings of $128,538. The company has 3673 subscribers, mostly in Paterson, Jersey City, Hoboken, Orange, Brooklyn, Williamsburg, and Greenpoint.

The Equitable Telephone Co. was incorporated on the 16th of January, capital $3,000,000. The trustees are James M. Blanchard, George Doyle, William Orton, John Robertson, Calvin Littlefield, Harry D. Lockwood, Edward Hatch, O. Bailey, and H. P. Bell. The officers are H. P. Bell, President; William Orton, Vice President; John Robertson, Secretary; and Edward Hatch, Treasurer. The company owns the Robertson telephone patents.

The new certificates of stock of the New England Telegraph and Telephone Company are now being distributed to take the place of the temporary certificates which have been held up to the present time. The new certificate is very neatly printed on bank note paper, in green. The plate is very finely engraved, and besides the text and ornamental devices, bears the coat-of-arms of the six New England States. As a matter of fact the present working territory does not cover Connecticut and Rhode Island, although the franchises of the company include that territory.

A dispatch from Chicago says that the Bankers and Merchants' Telegraph Company has acquired control of the Board of Trade lines, running from that city, by way of Springfield and Peoria, to St. Louis, and also of the lines of the Pacific Mutual Company, extending from Chicago to Kansas City. Under the management of General Manager Mott the system will be extended and enlarged, and it will also build a line between Chicago and Cleveland, with a capacity of twenty wires. Ten of these will probably be strung within the next sixty days.

The opposition to the Bell Telephone Company, knowing well the weakness of the Drawbaugh claim, now set up Antonio Meucci, of New York (who experimented from 1849 to 1875), as the great and only original telephone inventor. The public is truly long-suffering and kind in lending its ear to the claims of original inventors.

Daniel Drawbaugh set up (in thousands of newspaper columns) that he was a poor Pennsylvania Dutchman, who invented a telephone before Bell, but was too poor to obtain his patent. If the Drawbaugh case ever comes to trial, Daniel Drawbaugh will be shown up as a patent solicitor by profession, with money at interest and taking out patents for a bread-kneader and other minor inventions of his own after the date of his claims to the invention of the telephone.

DUBUQUE, IOWA.—The Iowa and Minnesota Telephone Company was consolidated, February 1st, with the Iowa Union Company, of Davenport, assuming the former name. The officers elected to serve the consolidated company are: J. K. Graves, president; J. T. Lane, of Davenport, vice-president; W. G. Peaslee, secretary; C. H. Harris, treasurer.

Competition in Electricity.

ALBANY, N. Y.—An examination of the records in the Secretary of State's office shows that within the last three years the number of companies incorporated under the telegraph companies act is 135 distinct organizations, with a capital aggregating $225,000,600. This includes numerous telephone companies, some of a local character, and also schemes for the promotion of every phase of electrical contrivances for the transmission of intelligence. In no other single line of activity do the records of the Secretary of State show anything like the competition illustrated by these figures. This condition of things will be of interest in view of the discussion at Washington as to whether the Government shall go into the telegraph business.

The Telephone in Belgium.

The truly wise and unprejudiced spirit in which the Belgian Government is now advancing the cause of the telephone in that country is deserving of the highest praise, and we hope to see its example followed elsewhere. Regular concessions have lately given the Campagnie Belge du Téléphone bell the status which it wanted, and the prospects of the shareholders who have not since its promotion received any dividend, are excellent. This progressive spirit, it must be stated, has only lately been shown by the Ministry, the telephone having been neglected by it for a considerable time. It must, however, be conceded that the Belgian Government is now making up for lost time. We have already referred to the connection between the telephone exchanges and the central telegraph stations in the large cities of the country. An even greater step in advance is now being taken. The Belgian Ministry has decided to devote part of the telegraph lines to an installation of long distance telephony on the "Von Risselberghe" system, in order to place the existing telephone exchanges in telephonic connection with each other. It may be remembered that the experiments made about four months ago proved that the telephones of the Belgian Company were perfectly adapted to long distance communication. The number of subscribers to the telephone exchanges will, of course, increase very rapidly. During the last year the increase was moderate, 278 new subscribers having been obtained. This makes 2,040, of whom 536 are at Brussels, 748 at Antwerp, 272 at Ghent, 208 at Charleroi, and 256 at Verviers. It stands to reason that the increase will henceforth be much more marked. Considering Milan has 1,400, Genoa 1,000, Rome 1,000, Amsterdam 1,200 subscribers, the Belgian exchanges may be expected to grow to at least three times their present members. The Belgian Bell Company is pushing the extension of the system most energetically. It is expected that the new long distance service will be opened in about two months, when Belgium will present the only instance in the world of the inhabitants of all the great cities of a country being able to speak to each other by the telephone.—*Postal Telegraph and Telephone Gazette.*

Long Distance Telephoning.

It is expected by the Southern New England Telephone Company that the new copper wire now being extended between New York and Boston will be ready for use in about two weeks. Hitherto copper wire was drawn so soft that it would not stand the strain of long-distance stretching; the new wire is "hard drawn" by a recently discovered process, is much stronger, and it is thought will neither sag down nor break. Copper wire is much better than iron wire for long telegraph or telephone circuits, its conductivity being much greater and its induction much less. While the new line is as yet an experiment, it is thought it will prove a satisfactory medium for long-distance conversation. It will be a metallic circuit, that is, the wire will not be grounded. If it proves a success, the Southern New England Telephone Company will at once begin the erection of another copper wire from New York to Boston, with stations and connections at all the principal cities. These will be the longest distance wires in use in the telephone business in the eastern United States.

The line now in process of erection will pass through New Haven and Providence; the line to follow, if the first one proves a success, will run through New Haven, Hartford, and Springfield. The officers of the telephone company look for great results from the new wires.

Our contemporary, the Boston *Transcript*, published the following on Wednesday. The main points referred to were discussed by us editorially in our edition of last week. Our readers will be interested, however, in the remarks referring to the matter of obtaining a patent from Congress:

"When the operations of the alleged friends of that Pennsylvania Dutchman, martyred to science, Daniel Drawbaugh, confined their enterprising operations to maintaining—first, in the newspapers, and, secondly, in the courts—that there are other claims than those of Alexander Graham Bell to the invention of transmitting speech by wire and electric apparatus, we are content to listen, applaud and encourage either or both parties to such a contest; but when the friends of Daniel Drawbaugh come before the public and invite the ignorant and the learned, the wise and the simple, to subscribe to a stock enterprise, the matter is quickly upon another footing, and is judged from entirely a different and more searching point of view.

"The Drawbaugh Telephone and Telegraph Company, organized under the laws of the State of New York, for operation in Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia, has a capital of 300,000 shares, of $50 par value, or $15,000,000 capital, and is endeavoring to sell its stock in New York, Philadelphia and Boston at $15 per share. For this purpose it has allied itself with a very reputable banking house in Philadelphia. The most taking thing about this company is that it bears the name of Hon. George F. Edmunds, of Vermont, as counsel. It is largely upon such good connections that people are investing in the Drawbaugh stock. But who ever heard of a lawyer declining to engage in a legal contest where the fee was large and 'cash down,' whatever the moral or financial status of the parties engaging him as counsel? And it should be neither to the credit of the Drawbaugh company nor to the discredit of Senator Edmunds that he is counsel therefor. The Drawbaugh Company, which has capitalized itself at $15,000,000, and is selling its stock at 30 per cent. of its capitalization, or upon the basis of $4,500,000, is only a local company, covering the States above named and paying tribute to the parent Drawbaugh Company — the same royalty tribute every sub-company now pays to the American Bell Telephone Company, or within one dollar per telephone thereof. Now, we will agree to accept a reasonable commission for the purchase of the entire telephone interests of the States above named as at present existing, including telephone plants costing several million dollars, the result of five years' experience, the use of scores of patented telephone improvements and all contracts and franchises, for considerably less than the capital of the Drawbaugh Company proposing to operate in these States.

"If the claim of the Drawbaugh Company that the invention of the telephone does not belong to any monopoly, but is open to the public, is maintained, what is it that the Drawbaugh Telephone Company is selling a part of for $4,500,000? And if the Drawbaugh is to be a monopoly superseding the American Bell Telephone, what has it now that is worth relatively so much more than the existing telephone properties in this section of the country?

"It is reasonable to suppose that the Drawbaugh Company holds out to the investors who buy into its lawsuits at 30 per cent. of their face value the expectation that their investment may be worth the par value. Now, what are the chances, even in the event of successful litigation, that the Drawbaugh Telephone and Telegraph Company, of New York, Pennsylvania, etc., will be worth $15,000,000? The existing telephone plant in these places is selling for less than $10,000,000. To pay 6 per cent. upon $15,000,000 would require $900,000 of net earnings, or about 50,000 telephone subscribers paying the usual profit of $20 each.

"Now, there are not in this entire territory, after five years of progress, many more than one-half that number of telephone subscribers. Sanguine, indeed, must be the expectation of telephone promoters who expect in a brief time to get all the existing telephone business and as much more besides.

"The control of the telephone business of the United States, as represented in the American Bell Telephone Company, is to-day selling for less than $15,000,000, yet the Drawbaugh people, with no other asset than a lawsuit to throw open to the public the telephone business of the country, has the solid effrontery to invite subscriptions to a local or sub-company, capitalized at $15,000,000, and for which $4,500,000 in cash is the modest price asked. John Law and his South Sea colleagues were gentlemen in comparison with these schemers.

"We have received the following communication:

"'NEW HAVEN, Jan. 26, 1884.

"'*To the Editor of the Transcript:*

"'DEAR SIR,—Will you please answer the following questions in your financial columns: If the Drawbaugh Telephone Company succeed in their suit with the American Bell Telephone Company, will it open the telephone business to the public competition, and would it be necessary for Mr. Drawbaugh to have a special act of Congress in order to secure his patent?

"'Very truly yours,

"'NEW HAVEN.'

"The nominal object of the Drawbaugh Telephone Company is to throw the telephone open to the public, and this would be the practical effect of legal decisions in its favor; but the real object of the Drawbaugh Telephone people is by demonstration in the courts, and the frightening of the Bell Telephone Co. stockholders, to force the Bell Telephone Co. into an alliance by which both parties shall procure by act of Congress a patent for Daniel Drawbaugh, which the Bell Telephone Company shall purchase, and which will extend the Bell Telephone monopoly for several years beyond the expiration of its present patents. It is not an enterprise to benefit the public, but to enrich a few schemers by the practical extension of the existing monopoly. The Drawbaugh people seek, in the most outrageous manner, to capitalize political influence, not in the interest of the inventor or the progress of invention, but to enrich themselves, and prevent the telephone becoming public property. The managers of the American Bell Telephone Company would not be held in the high esteem they are at present in this community if they entered into any such alliance."

At the Little Rock, Ark., Telephone Exchange lately, a call came in from a residence for a feed store.

"Hello!"

"Hello! what is it?"

"Mamma says send up a sack of oats and a bale of hay," in a child's voice.

"Who is it for?" inquired the feed man.

"Why for the ceow," drawled the youngster, and closed up, leaving the man to cuss the telephone.

The American Bell Telephone Company.

Our esteemed contemporary, the *Postal Telegraph and Telephone Gazette* (London), makes the following interesting comments on the Bell Telephone Co., showing the English view of our telephone affairs in this country:

"The question of the telephonic centre in the United States after vibrating between Boston and New York, finally settled upon the former place, which might now be aptly termed the voice and ear of the Union. The telephone interest radiates from Boston to the uttermost parts of the earth. The American Bell Telephone Company, the parent company of the United States, have here their business offices, as have also the principal companies which are operating in the countries to the south of us, Mexico, Central America, South America. When we consider the short space of time since the first telephones were commercially introduced, the progress in telephony has been simply marvelous. Now the number of telephones in actual use in the United States is over 300,000, and a steady stream of them runs from the manufactory to the awaiting subscribers, adding many thousands each month. A few years ago the original company found a difficulty in raising a few hundred dollars for business purposes; now bonds are sold at a premium by the hundred thousand. The various telephone companies operating in the southern foreign countries, obtain all their instruments and apparatus from the American Bell Telephone Company, with which they have contracts to this effect; so that in addition to the home consumption there is a large and constantly increasing export demand. The management to secure, hold, and enlarge such immense interests has been of a bold, aggressive character, and at the same time a very conservative one—very liberal in its outlay and policy, and yet not wasteful or extravagant. It has been far-sighted, and the future has not been sacrificed to the present. All the telephones and transmitters are manufactured in this city, by the Western Electric Co., as are also many of the telephonic accessories, such as magneto-bells, switch-boards, &c., although the greater part of the latter are made in the company's manufactories in other cities, only one branch being located here. It is not to be supposed that such an extensive enterprise has been allowed to continue its existence without being questioned or pursued by rivals. No great invention ever showed its front that had not to meet claimants and enemies, but so far the Bell Company has been able to evade or throw off all the shackles which have threatened to bind it. The policy of *silence* seems to have been adopted concerning its affairs—it is quiet while its stock makes long vibrations downward, when a word, officially, as to its business standing, would restore the equilibrium. It never notices the various questions, allegations, or rumors circulated from time to time, except in the courts, where the answers have been emphatic, but has devoted itself wholly to business, to the enlargement of its plant and the earning of dividends for its stockholders. The usual 3 per cent. quarterly dividend has been declared by the American Bell Company, although it is generally understood that their earnings would warrant a higher rate."

The Telephone Problem in England.

The condition of the telephone in that country must be considered an anomalous one, and the *Postal Gazette* says that it is one which will demand the serious attention of the Postmaster-General at no distant period. There is no denying it, that the progress of the telephone is retarded in some measure by the relative position of the postal authorities and the telephone companies. The latter are anxious to develop their systems as rapidly as possible, in order to make the most of the time during which their patents are secured to them. This wish on their part is natural enough, but as it tends to create a formidable competition to the postal telegraph system, there is naturally a desire on the part of the postal telegraph authorities not to let the telephone grow out of leading strings. The principal patents will run out in about seven years, and we suppose it is thought that if matters can be kept on the present footing for that period, it will be easier and much less expensive for the post-office to take over the telephone. We take it for granted that the latter step will have to be taken, sooner or later, unless the post-office authorities are prepared to see the revenue obtained from the telegraph dwindle down very rapidly. It is no use mincing matters. The telephone will become a very serious competitor to the telegraph, as soon as the different telephone exchanges in the country are placed in direct telephonic communication by means of trunk wires. It must come to that eventually, and we do not think that the English public will submit to being kept without telephone facilities which are being provided throughout the neighboring continental countries. We do not pretend to know whether the conditions made by the Postmaster-General absolutely prevent the connection of the different telephone systems. It appears, however, to be the opinion of the telephone companies that a more liberal policy might with advantage, both to them and to the public, be pursued in the matter. There are other facilities, such as the connection by telephone of central telephone exchanges with the chief telegraph stations in the same cities, which are already in operation in the case of the Government telephone exchanges, but which have not yet been introduced into the telephone exchanges of the companies—as the latter say, because the conditions on which the Postmaster-General is inclined to grant the connection are too onerous. The question of the establishment of cheap telephone messages, as proposed by Mr. Batten, of the United Telephone Company, will also have to be dealt with, and we may expect considerable discussion of the matter in this year's session of Parliament. The issue, we opine, will resolve itself into the following two questions: Is the telephone eventually to be taken over by the post-office and to be worked in connection with the postal telegraph? or are the private companies to continue the *exploitation* of the telephone? If the former is to be the solution of the problem, it will be useless to wait for seven years, and the only proper policy will be to face the matter and buy the companies out. If the companies are to continue to provide telephonic communication, reasonable facilities ought to be given so as to allow the telephone to develop itself as rapidly as in other countries. Of our nearer neighbors, it is notably Belgium which has lately adopted a very progressive policy in this direction. We feel convinced, from the well-known liberal views carried out by the Postmaster-General in all his departments, that he will give due weight to public exigencies, and that the public will demand a free and speedy development of the telephone throughout the United Kingdom as a most useful instrument for trade, and a great convenience for the entire community.

The Telephone Situation.

Our esteemed contemporary, *Bradstreet's*, comments as follows on matters telephonic:

"The telephone interference case between the Bell interest, on the one side, and the McDonough interest, on the other, upon which a decision was rendered by the chief examiner of the Patent Office last summer, promises to reach a final decision soon. It will be remembered that the examiner's decision awarded to Bell priority in the art of telephony, and to McDonough the priority in the construction of the magneto receiver—the one in universal use to-day. On the face of it, the effect of this decision is to give McDonough the right to interdict the use of the magneto receiver by the Bell Company, while McDonough himself is debarred from embarking in the telephone business by the award to Bell. The art of telephony, to which Bell is adjudged to be entitled, is that of transmitting speech electrically by means of undulating currents. As it is claimed by the Bell Company that the transmission of speech is impossible except by the use of such currents, it would seem that the two contestants are left by this decision in a position in which each can prevent the other from using a complete telephone system which neither can himself employ. It is claimed, however, on the McDonough side, that the examiner's decision, in fixing the date of the McDonough receiver, fixes also the date of his transmitter, and that hence the award of priority to Bell for the art of telephony cannot be upheld.

"McDonough, in fact, claims to have constructed both a transmitter and receiver, and to have sent and received articulate speech by means of them prior to Bell. Whether Bell was the first to use an undulatory current or not in the transmission of speech is evidently of no consequence, if instruments were made prior to his which would transmit speech. In view of this state of the case, the decision of the examiner has a greater value for the McDonough interest than at first appears; and, if it be sustained by the higher tribunals to which it can be appealed, the control of the telephone may pass from the hands of the American Bell Co. There are three appeals within the limits of the Patent Office—the first from the examiner to the Board of Examiners, the second from this latter to the Commissioner of Patents, and the third and last to the Secretary of the Interior. This latter is final, so far as the Patent Office is concerned; but there still remains the adjudication of the courts, before which the case can come up as a matter of infringement. The Bell Company has taken the first of these appeals, the hearing on which was set for the 11th of last month. As the review of the case by the examiner-in-chief was prolonged—the case having been before the officer for about three years—and the evidence submitted exhaustive, it does not seem probable that the decision will be long delayed. For the same reason, decision on the other appeals, if they are taken, will probably not be long postponed, so that the final decision may be reasonably expected in the coming year.

"How a final decision in these fundamental patents against the Bell Co. will affect the users of the telephone it is difficult to say. The present telephone service is rendered by a number of local companies operating local telephone systems or exchanges, as they are called. These are licensed by the Bell Telephone Company, to which they pay royalties for the use of all the telephone patents controlled by it. The total capital of these companies is a very large one; their plant is in place, and in almost all cases a paying business is being done. No new company would, therefore, find it a desirable or a profitable thing to attempt to oust them. It would, therefore, in all probability, take toward them the same relation now occupied by the Bell Company. In fact, this is the avowed programme of the McDonough Company. With such a disposition of the telephonic forces, the benefit accruing to the user from a change of licensees will be that which it pays to give. The McDonough Company claim to be able to offer to the local companies greater facilities for the transaction of their business in the form of improved and automatic switching devices, in place of the present apparatus in use in the exchanges, and to be content with lower royalties than those demanded by the Bell Company.

"From the point of view of the stockholders of the Bell Company, even much more sweeping decisions than are at all likely to be obtained would not be cause for much disquietude. Nothing is more difficult in the commercial world than to wholly dislodge a large financial interest once thoroughly in the possession of the field. Its acquired strength always gives it the ability to compromise with any or all opponents, and, if it cannot remain in control, to at least retain the major part of the advantage of its position. To this the Bell Company is no exception. The most that it can lose by the loss of its patents are the royalties now paid it by the local companies. It does not seem to be generally known, or, at least, to be usually taken into account, in estimating the effect of this patent litigation, that the Bell Company is a large holder of the various local stocks—has, in fact, a controlling interest in the majority of them. Whatever the transmutations, then, of patent litigation, the Bell Company is still possessed of a very substantial property, of which nothing but the dissolution of the present local companies can despoil it. As indicated above, the probability of this occurring is too small to be taken into consideration.

"McDonough is, however, not the only contestant in the field. There is another, who claims to antedate both McDonough and Bell, and whose claim, if substantiated, may seem at first sight to wholly alter the telephone question as above presented. This is Daniel Drawbaugh. He claims to have made a rude, but still a working telephone as far back as 1867, and it is claimed for him that he has since been engaged in perfecting the invention as diligently as his means would allow. It is claimed by his opponents, however, that, admitting his invention of the telephone at the time claimed, he abandoned it, and hence is not entitled to patent protection. The plea of abandonment is based upon Drawbaugh's patenting various miscellaneous devices during the time it is alleged he was not able to protect his telephone on account of insufficient means. The claims of Drawbaugh have not yet been passed upon by any court, but a suit, brought by the Bell Company against the People's Company, which owns this invention, is now pending in the United States Court for the Southern District of New York, and is expected to be decided soon. If Drawbaugh is finally adjudged the inventor of the telephone, the McDonough as well as the Bell patents become invalid, and if it be held that there was abandonment on the part of Drawbaugh he cannot secure a patent, and the telephone therefore becomes public property.

"It must not be supposed, however, that this will throw the telephonic field open to all comers. The telephone itself is but a part of the complete set of appliances that constitute a practicable commercial telephonic system. Without the central station to which the wires of all subscribers run, and at which different subscribers are constantly being put in communication, telephonic communication would be impossible except by separate wires from every user to every other user. This would demand an outlay in the shape of plant so great as to prohibit the use of the telephone entirely. Both the McDonough and the Bell interests claim to have patents, without infringing which no practicable telephone exchange can be operated. After the settlement of the question of priority in the invention of the telephone, the contest will very probably be carried into the question of mutual infringement of these devices, unless the contestants in the meantime reach a mutually satisfactory adjustment of their claims.

"This latter seems the most probable upshot of the matter. This will leave the present distribution of the telphonic forces practically unchanged, and the question of improved telephonic service at reduced rates to be determined by the business interests of the companies engaged in the business.

"That such an arrangement will result in giving the public a cheaper and more efficient telephone service than the present hardly seems probable. But at the same time, it is by no means certain that this would result from the competition of many more companies. In a commercial enterprise of this sort, requiring an expensive plant confined of necessity to particular districts, the duplication of companies gives no guarantee of cheaper or better service.

"The dividends have to come out of the consumer, and the capital upon which dividends have to be earned is always certain to be larger if distributed among several than if confined to one company."

The Brush Electric Light & Power Company, of Buffalo, has increased its capital to $500,000. Also that Supt. S. A. Duncan, of the Brush Co., at Pittsburgh, Pa., operated recently 58 standard Brush lamps (2,000 candle power), on a 1½ mile circuit, using a No. 8 Brush Dynamo, having the new armature. The circuit is of No. 6 wire.

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Western Union vs. Baltimore and Ohio.

The purchase of the National Telegraph Company's lines by the Baltimore and Ohio Telegraph Company, and the plan of general extension which the last-named Company has conceived and is about to execute, may fairly be said to solve the problem which for some time has been prominently before Congress for solution. If the Baltimore and Ohio Telegraph Company was an insignificant organization, whose directors were little better than stock-jobbers, anxious to make a valuable property, only that the price of their treachery to the people, to be exacted from the Western Union should be enhanced, it might expect nothing from the REVIEW but exposure. But such is, happily, not the case. The Baltimore and Ohio Telegraph Company is of the most reliable kind. It is supported and controlled by the Baltimore and Ohio Railroad, and should it carry out its plans, will constitute the first genuine rival to Western Union that has appeared in the telegraphic field.

There are no Jay Goulds behind the new competitor with Western Union, but, on the contrary, men of well known integrity, who are not known, as Jay Gould is, for stock-jobbing, hypocrisy, and unblushing rascality.

If the new company fulfills the promise of its Spring, there will scarcely be any need of either a government telegraph—that is for general business—or for government control.

For the new company, unencumbered with a load of eighty millions of dollars to pay interest on, will, likely enough prove, when fairly started, more than a match for Western Union, with its load of stock and its stock-jobbing management.

The new company proposes, so soon as the frost is out of the ground, to begin building its main and adjunct lines, but besides these and still more important, are the arrangements which it has already made with a number of railroads for leasing their telegraph lines when their contracts with Western Union shall have expired. In accordance with this, the New Jersey Central Railroad notified the Western Union that the contract between them which is about to terminate will not be renewed.

It looks as though the coming year is going to be a somewhat unfortunate one for telegraph and cable monopolies. If we read the telegraph horoscope correctly, we should predict that very heavy weather will prevail in the vicinity of Western Union, and that the old hulk, unless very skillfully managed, will get into the trough of the sea, or, as the sailors say, athwart seas on account of her being so top-heavy.

Should this be the case, some of the crew will be compelled to unload. Flurries of unfavorable weather, and a painful frequency of black squalls and uncanny weather, have already been reported from abroad, where the Anglo-American Cable Company, which may be looked upon as a co-conspirator with the Western Union against public interests, is having a shocking time. It is only a short time ago that they adopted Jay Gould's tactics, and they were scarcely over congratulating themselves upon their immense success in the little game of extortion—their stock having been in active demand at ridiculously high rates—when, lo! the Bennett-Mackay storm caught them with all their sails set, and was like to have overturned them entirely. The party righted their old hulk, however, the color gradually got back again into their faces, the nervous twitching of the knees ceased, and, making up their minds that it was only a passing squall, demanded of each other, "Who's afeard?" But Mackay writes to the London *Times* that the Bennett-Mackay Cable Company could not be induced, under any circumstances, to sell out, and propose to carry on a cable business in good faith with the public. This is really too much, and the Nine Cables Monopoly Company's stock again has the bottom knocked out of it.

But the worst is not yet come. Another cable is to be laid by the Merchants' Cable Company. The Merchants' Telegraph and Cable Company have filed articles of association in the County Clerk's office. The incorporators of the new line are Thomas L. James, Anderson Fowler, C. D. Borden, Edward A. Quintard, David Bingham, William A. Cole, Edwin R. Livermore, Henry W. Edye, Adolph D. Strauss, John H. Herbert, John F. Plummer, Edward H. Tobey, and Vernon H. Brown. The immediate purpose of this company is to lay a cable line from this city to London. The line will be a direct one, though the point of landing it on the English coast has not yet been selected. The organization originated in the Produce Exchange, and is principally intended to supply the needs of the members in the way of direct international communication. The articles provide for the future construction of lines to France and Germany. The capital stock is $13,000, in 130 shares of $100 each. Provision is made for an increase of the capital to an amount not exceeding $20,000,000. Active operations will be begun at the earliest practicable date.

Failing in an attempt to buy out the Bennett-Mackay scheme, or, at least, to dissuade its projectors from entering the cable field by all kinds of cable facilities, Gould determined to buy out the Nickel Plate telegraph lines, in order to keep them away from the Baltimore and Ohio people. Foiled here, he had himself interviewed, and said that the new additions to the Baltimore and Ohio Telegraph Company, viz., the National and the Nickel Plate, would have no effect upon the Western Union Telegraph Company, and that the latter-named company did not pay expenses. But such reckless falsehood was to be expected from Gould, who, only a few weeks before, had been doing his best to purchase this same line, as has been seen.

Mr. Robert Garrett, president of the Baltimore and Ohio Telegraph Company, when questioned concerning this Gould interview, said: "I am very glad to get an opportunity to say a few things to you about telegraph properties in this country. I was asked by Mr. Gould to become a director in the Atlantic and Pacific property, and before deciding not to become one I went carefully over the books of that concern, and it will probably surprise the public to know that the total amount of cash put into the Atlantic and Pacific by Gould and his friends was less than a million of dollars. Mr. Gould afterward sold this property to the Western Union for, I believe, $9,000,000 I did later on become a director in the American Union Telegraph Company. This property cost, I believe, about $4,000,000, although some additional sum in money may have been turned over to the Western Union when it purchased the American Union Company for $15,000,000, and upon the acquisition of these two most valuable properties an extra dividend of $15,000,000 of Western Union stock was declared. In other words, about $40,000,000 of Western Union capital to-day is represented by a cash expenditure of $5,000,000. Since that the Western Union has guaranteed, I believe, some $10,000,000 of the bonds of the Mutual Union Company, and I have never heard it asserted that the face of those bonds went into the property. They have, I believe, also guaranteed the stock of the Mutual Union, this latter concern, I understand, being largely composed of turnpike lines. They have also guaranteed 5 per cent. upon $14,000,000 cable stock, thus throwing on the Western Union the burden of paying the interest on $7,000,000 or $8,000,000 unexpended money. I know about the cables, since I was interested in them. Mr. Gould stated, when the Atlantic and Pacific was started, through his agencies, that the Western Union Telegraph was the most vulnerable property in the United States. He further said, later on, that a mistake had been made about the Atlantic and Pacific lines, that they were inferior, and that for this reason he had sold out; but, he said, at a price which puts Western Union in a still more vulnerable position than it was ever before. It was vulnerable, and proved to be so, for by the expenditure of about $4,000,000 Mr. Gould added about $3,000,000 additional to the stock of the Western Union. I do not understand how, to-day, after a lapse of a very brief period, even allowing considerably for the growth of telegraph business in this country, the Western Union is, as Mr. Gould says, the strongest telegraph company in the world. I am informed by the most competent authority that of the country from which the entire revenue of the Western Union Company, including foreign cable business, is derived, 50 per cent. is to-day covered by the Baltimore and Ohio lines. An additional 15 per cent. is covered by the lines of the West Shore and Nickel Plate, which we have just acquired, and an additional 10 per cent. will be covered by the line between Boston and New York, which we are now actively engaged in pressing forward toward completion. It will thus be seen that fully 75 per cent. of the entire business of the Western Union is to-day, or will in a very short time be, subject to our active competition. While Mr. Gould is running down the value of property, I would like to ask him how much of the debt of the Wabash he has wedged in ahead of the stock, and if he was not a short time ago advising people to buy Wabash stocks, which have since depreciated so enormously, with just as much energy and activity as he now displays in advising people throughout the country to buy Western Union. That this stock is as weak as water—that is, as water can make it—and, instead of being the strongest property, I agree with Mr. Gould's logic that it is the weakest property of the kind in the United States. On the other hand, the Baltimore and Ohio Co., with lines reaching the leading cities from which the great aggregate of paying telegraph business is derived (which to-day reaches the greatest number of these cities, and has only to string additional wires to make its lines thoroughly effective, and which is not being weighed down with non-paying lines), expects to derive satisfactory revenues from its telegraph investments. Mr. Gould lost the Nickel Plate simply because we topped him on his bid. We feel very grateful to him for his solicitude about the legal status of those lines, but we are satisfied on this point. I was surprised—very much surprised—at Mr. Gould's views about the Nickel Plate and West Shore properties, but I know he frequently and rapidly changes his views. When he first started the Atlantic and Pacific and American Union companies, he announced through his agents and others that he intended to give the public the benefit of cheap telegraphy, but when he consolidated the American Union with the Western Union he wrote to me saying it would be unwise to educate the people to too cheap telegraphy. In other words, I do not attach much importance to Mr. Gould's opinion about the Western Union and Nickel Plate lines, but the future will determine. I have this to say, however, that, if the public attach much importance to his opinions in these matters, they may be financially left."

Thus, as will be seen, the Baltimore and Ohio Telegraph Company will soon have lines in operation to all paying points throughout the country. Its opposition with Western Union is like to be bitter and long-continued, and the cutting of rates, which always follows such a condition of competition, is likely to bring them down to a popular point; besides, and, what is more to the purpose, insuring a first-class service.

With such a condition of things, it would be both useless and unnecessary, even if it were constitutional, which has by no means yet been proved, for the country to go into the telegraph business. Both companies would be compelled to employ intelligent, painstaking operators, and to use diligence in the transmission of messages.

Again, it is useless to talk about the relative rates of this country and Europe. The conditions are altogether dissimilar. No matter what the prevailing rates are there, when small lines of telegraph are operated, we must have cheap—yes, very cheap—rates here; and where such an immense system is operated, any honest company, which does not look to the general public to pay interest on its watered stock, can, we are convinced, earn good dividends with small

rates, while, at the same time, encouraging the use of the telegraph. Besides this, we have only the word of the Western Union Telegraph Company to assure us that the rates are cheaper here than abroad.

In France you can send twenty words for twenty cents of our money, and the average in European countries is only one-half a cent a word. You can send twenty words from France to Algiers, a distance of two thousand miles, for twenty cents of our money. Surely, this is much cheaper than the rates which now rule in this country.

The Relentless Gas Consumer.

All else having failed them, the gas companies, with an ingenuity which those who know them will by no means be surprised at, have hit upon a novel scheme for demonstrating that their charges are not extortionate. It might not inappropriately be called the newspaper-letter-from-consumer-racket. The game is played in this wise. Here is a gas company, the meters of which are so accurate that their faces will not indicate any difference between the gas consumption in a house when the inmates are in Europe or in town, burning fifteen burners four hours per diem. Now, let us suppose that the Secretary wishes to manufacture a little confidence in gas consumers. He sits down at a table and writes to a morning journal a letter that reads:

To The Editor of Times:

SIR:—I really cannot understand how any one can find fault with gas companies, or their bills. To me, these companies seem to be the personification of uprightness and modesty, whose only aim is to accommodate the public, make home pleasant, and leave to posterity an unblemished reputation. I get my gas from the Metropolitan Gas Company. I live in a four-story house between Fifth and Sixth avenues, and, as you can imagine, require a large supply of gas. Yet, on looking over my bills for gas I find that for the past six years, the average is only $61 and the highest for any one year was only $80.

Yours, truly,

A CONSUMER.

This scheme has much to commend it, it revives the drooping confidence of consumers and assumes for the gas company the rôle of persecuted saint. But, unfortunately, like most schemes it has its defects. A very important factor had been left out in the calculation. This was the liability of the *bona-fide* consumer to answer back, and this ridiculous tendency on the part of the consumer has, it is to be feared, completely spoiled the newspaper-letter-from-consumer-racket.

Here is one of the letters brought out by the original communication:

THE COST OF GAS-LIGHT.

To the Editor of the New York Times:

In the perusal of your paper this morning I read the article headed "Satisfied with his Gas Bills," and was surprised to find the amount he paid yearly for gas. Living as he does in a four-story house, between Fifth and Sixth avenues, and obtaining my supply of gas from the same source—the Metropolitan Gas Company—I had the curiosity to look over my bills for gas during the year 1883, and find they amounted to $211.96. When this "Householder" states that his average for gas for the past six years is only $61, and that his highest for any one year was $80, and that at all times he had an abundance of light, this discrepancy seems unaccountable, particularly as I am living very quietly, giving no entertainments.

ELUCIDATE.

New York, Monday, Jan. 28, 1884.

Is the Dynamo a Failure?

Our contemporary, *Engineering*, the leading scientific authority in Great Britain, discusses, in a recent leading article, the relative merits of electricity and gas as illuminants. After traversing the subject at some length it would seem, if we correctly interpret its meaning, to arrive at the following conclusions: 1st. That electricity, as distributed from a central Station, is far more costly than gas, and hence cannot compete with it. 2d. That the primary batteries, considered from a commercial standpoint, are, for the same reason, a failure.

It says that inventions relating to dynamo machines are no longer in demand in the city, by which it means London, and that whether the electric light can, or cannot, be supplied at the price of gas is a question which has been much disputed, and one that most people have decided must now be adjourned until the truth has been demonstrated on a grand scale. It is not, it goes on to say, difficult to estimate the expenses of an electric lighting station under certain assumed conditions, and if the lamps can only be taken up in sufficient quantities, and be burned a large number of hours each day, a very fair prospect can be made out.

"But everything depends upon a large and continuous consumption of current, for the annual expenses are enormously swollen by the items of interest and depreciation, and these go on whether the lights are burning or not.

This is a point, however, which is liable to escape notice, and people forget that the engines, boilers and dynamos will only be working at their full capacity, as a rule, for four or five hours a day in the Winter, and never in Summer; and when a comparison is made between this form of electric lighting and others, they are apt to be misled."

Now, without further ado, we will grant the premises adopted by our contemporary, but we must confess we find no little fault with its conclusions, which by no means follow as a logical sequence of those premises. That is to say, granting that the "items of interest and depreciation" are more important in the electric than in the gas plant, it does not follow that the public will prefer gas to electricity as an illuminant. Those who are engaged in estimating the relative cost of producing electricity and gas are wasting their time; they are wasting the midnight oil in a bootless search. And why? Because in a normal condition of the market, when the residuents of gas manufacture are in active demand, carburetted hydrogen gas can be delivered to the consumer at a cost to the gas company of twenty-five cents—say a shilling sterling—per thousand cubic feet. Surely the wildest dreamer will not claim that an electrical light company can furnish the same intensity of electricity to the consumer at such a figure. Assuredly not.

If our contemporary will pardon us for the contradiction, we will assert that, under the circumstances, this proves nothing at all. You can get bad tea for a tithe of what good tea will cost; you can get glucosed beer for but a small part of the sum pure hops beer will cost; you can get loaded sherry and fortified wine for a mere trifle, compared with what the genuine product of the vineyard will cost. Does that make spurious tea and ale and wine to be preferred to the pure article? Does the public clamor for them on that account, and eschew the good articles? By no means! That these spurious articles are in demand, none will deny. But by whom? By poor people, who cannot afford the expensive original; and by ignorant people, who think they are getting this. So it is with the electric light. The public, when fully aware of its advantages, will have none other; but doubtless the very poor will, for a time at least, have to content themselves with gas, poisonous as it is; and some not able even to afford this, must fall back upon the farthing dip.

"Recently inventors," says our contemporary, "finding dynamos received with suspicion, have been turning their attention to primary batteries as a source of current for electric lighting, and have held displays in various parts of the city to introduce these productions to the public."

If this statement had been made by the London *Electrician*, we should have paid no attention to it, for that alleged newspaper is so filled with mistakes, misstatements, and drivel that we have long since ceased to regard it seriously. But being made by a reputable journal like *Engineering*, it calls for some explanation, and we would be pleased if it would sustain this remarkable assertion by informing us who are these inventors who have found dynamos to be "received with suspicion." Where were they received with suspicion? and upon what is the suspicion founded?

It seems to us that dynamos, instead of being received with suspicion, are, now that their peculiar merits are become known, received with unusual favor. We could, if we desired, fill pages with evidence of their unqualified success on this side of the water, but we will content ourselves for the present with presenting concise and explicit testimony of the success of these remarkable machines, in the very country and provinces of the same where our usually well-informed contemporary says they are regarded with suspicion.

Following will be found a partial list of the principal installations of dynamo plants effected in England and her dependencies during the year 1883, by *one* electric lighting company: Holborn Restaurant, House of Commons, A. & S. Gatti, Waterloo Station, City and Guilds Technical College, Criterion Theatre, Laing, White & Wharton, New Law Courts, Nine Elms Station, London; Sir M. W. Ridley, Bart., M.P., Blagdon Hall, Northumberland; Coxon & Co., Newcastle; Captain Markham, Morland, Penrith; Rowntree & Sons, Scarboro'; Webb Brothers, Randalstown, Ireland; C. M. Palmer, Esq., M.P., Loftus, Cleveland; Bowyer & Priestley; Duff & Rowntree; Great Eastern Railway Hotel, Parkeston, T. Richardson, Esq., M. P., Yarm, Yorkshire; W. F. Moore & Sons, Isle of Man; J. H. Gartside & Co., Manchester; Simpson & Denison, Dartmouth. The installation at the House of Commons, which ran so successfully during the last session, is being increased by the addition of about 220 lamps, which will bring the total number up to 500. The entire plant will be in readiness for the opening of Parliament on the 5th February. The Holborn restaurant installation, consisting of plant for 500 lamps, is being augmented by additional engines and dynamos for 1,200 lamps, which will make this installation, when completed, the largest isolated plant in England. The Central Lighting Station at Victoria is rapidly approaching completion. The company has at present on hand orders for lighting four additional troopships for H. M. Government—the Crocodile, Serapis, Jumna, and Euphrates—besides various contracts for steamship plants. They are also about to carry out installations at the Cannon Street Hotel; for Messrs. Shanks & Co., Johnstone, N. B.; Messrs. Brown Bros., Galashiels, &c. The amalgamation of the Edison and Swan Companies has taken place, as our readers are aware, during the past year, and the offices of the United Company are now at 74, Coleman Street, London, E.C. Steamship Ruapehu: This fine steamship, the third of three vessels lately built by Messrs. John Elder & Co., of Glasgow, for the New Zealand Shipping Company, went her trial trip on the Clyde last week. Like her sister ships, the Tongariro and Aorangi, she is fitted throughout with the system of electric lighting. The generating plant, which is in duplicate, consists of two 250-light Hopkinson dynamos, running with full load at about 470 revolutions per minute, and driven by rope belting from two of J. & H. Gwynne's vertical high speed engines. The Ruapehu left the Albert docks for New Zealand on the 10th instant. Cannon Street Station Hotel: The Swan Company is about to light the grand and pillar halls of this hotel with about 200 lamps A Marshall vertical engine and a dynamo will be used. Factory lighting in Scotland: The Swan Company is about to install a 250-light plant at Messrs. Shanks & Co.'s new works in course of erection at Johnstone, N. B. They are also about to lay down a plant of two K dynamos for lighting Messrs. Brown Brothers' new tweed mills, at Galashiels, N. B.

The Indian and Colonial Electric Company is lighting the Parliament Houses at Sydney, New South Wales, under contract with the Government, and also the Government railway station between Victoria and New South Wales. The General Post Office in Sydney is partly lighted, and during the past year the company has lighted the Volunteer Camp at Sydney. In Queensland a contract has been made with the Government to light the Government House, and the Government printing establishment is also being lighted. The first mill illuminated by electricity in the Australian Colonies was fitted up by the Indian and Colonial Company in Queensland. In New Zealand the company is also lighting the Government printing offices at Wellington. The report with reference to the whole of these works in the various colonies has been uniformly satisfactory. In Melbourne the company has been lighting one of the chambers of Parliament House for many months past with the greatest success.

The Anglo-American Brush Electric Light Company, limited, has just completed manufacturing for the South-Eastern Brush Electric Light and Power Supply Company, a quantity of valuable apparatus for installation at Baron Rothschild's new mansion at Aylesbury. The most noticeable portion of the plant consists of two of their well known No. 8 40 light Brush dynamos which are in this case fitted with a novel and ingenious arrangement by which the machine can be made to give at pleasure a current of either 10 or 20 ampères, the E. M. F. being at the same time altered in an inverse ratio: this is effected by the simple operation of moving the handle of a switch, thus enabling the same dynamo to be used at night for generating the small current which is required for driving the full number of Brush arc lamps for which the machine is designed, and when not so employed it can be made to give double the quantity of current for the purpose of charging storage batteries. It will be seen at once that this greatly increases the amount of useful work which can be got out of these powerful dynamos. Another very important and perhaps the most striking feature of the installation is 12 automatic lamps for the illumination of the grounds. They are each of 4,000 candle-power, and are placed on stands, adjustable in height, which are fitted with powerful parabolic reflectors, capable of being turned in any desired direction, in order that they may concentrate a very powerful beam of light on any piece of statuary, fountain, or especially beautiful portion of the grounds, at the same time shedding a flood of light over the whole of the area that they are intended to illuminate. Amongst the other articles supplied are six lamps of an ornamental character for lighting the conservatory.

On the evening of the 4th inst., the occasion of the annual ball to the tenantry of Mr. C. H. Wilson, M. P., at Warter Priory, the mansion was illuminated by the electric light, which has recently become the means of lighting the Priory, and has been found to answer most admirably. The lighting has been supplied, with all the necessary appliances, by Messrs. J. Edmundson & Co., of 19, Great George Street, Westminster.

The illumination consists at present of 180 Swan incandescent lamps, of various sizes, their lighting power varying from 10 to 40 candles. These are distributed over the whole of the mansion, being tastefully arranged in the reception rooms. Many of the existing candelabra, &c., have been utilized and adapted to carrying the new means of illumination. The large hall and all the passages and corridors through the house, and a few of the bedrooms, are lighted by electricity, as are also the whole of the servants' departments, kitchen, offices, &c. The wires have been easily carried throughout the house, and they are well insulated and protected by wood castings, whilst at every branch a lead safety fuse has been supplied, with a view of guarding against any risk of fire, which might result from the wires becoming heated by any accidental short circuit. The various fittings and brass work for carrying the lamps, where the existing fittings have not been utilized, are neat and simple. The current of electricity is supplied by two dynamo machines, about one hundred yards distant from the mansion, an existing outbuilding having been utilized as an engine-house. The dynamos are each

capable of supplying 65 lights of 20 candle power, and are coupled together in such a manner that either or both may be used as required, and they have been made self-regulating, so that when a portion of the lights are turned out the remainder are not affected, but remain at the same degree of brilliancy. As the two dynamos only supply 130 lights, those fitted in the mansion cannot all be kept burning at the same time, but those not required are turned out. The new illumination is being tried as an experiment to enable Mr. Wilson to judge of the success of the lighting on a small scale first, afterwards to be extended as required by more lights and additional dynamo machines, as it will require nearly 300 lights to thoroughly illuminate the whole premises, including stabling, &c. The motive power is at present supplied by one of Marshall's portable engines of 8-horse power, which will be replaced by a permanent engine when the further extension of the lighting is completed. The whole of the apparatus is easily attended to by one man, and a careful account of the cost of working is being kept. An experience as to the working of the light during the three months it has been in use shows, it is understood, a considerably less cost than is usually the case in such a country mansion when lighted by gas. The light is perfectly steady and most agreeable.

The lighting of the Grangemouth Docks by electricity has now been nearly completed; lamps were lit up on Monday night. The Hammond Electric Light and Power Supply Company have just successfully completed installations at the Prince of Wales' and Royal Theatres, Birmingham. Ferranti machines are employed, driving Swan's 123 volt lamps of 20 nominal candle power, but running at about 25 candles each. The light has given great satisfaction, and elicits rounds of applause nightly, being the first exhibition of the high tension lamps in the Midland Counties. The installations were carried out by Mr. T. H. Seymour Hawker, district electrician of the company, and Mr. H. South.

In this partial list, which, with one or two exceptions, is made up of the work of only one electric lighting company in England and its dependencies alone, we have left out the names of more than three score great steamships which, by aid of the "suspicious" dynamo as an adjunct have been lighted with the electric light during the year just past.

We have refrained from recounting the success which has recently been attained by the dynamo in America, because our contemporary in its charges referred inferentially to Great Britain alone. We will say, however, *en passant* that as wealth is more distributed here than in England, the demand for superior service is far greater.

In a subsequent article we propose to take up and examine the second proposition of our English contemporary, viz: that the storage battery is not a commercial success.

The Electrical Development and Manufacturing Company.

The prospectus of this new company which comes into existence at a timely moment will be found in another column, and should command close attention, for its objects are commendable in every respect, and its aims and purposes will appeal to our readers as worthy of their support.

It will be seen that it is the object of this enterprise to awaken an interest in a subject that has not received the careful attention it has so long deserved. Capitalists are not disposed to touch the many valuable inventions that are now seeking their support, partly from a lack of knowledge upon technical subjects, and largely from the lack of time necessary to investigate and ascertain the true value of the inventor's device or apparatus. Many valuable inventions are lost entirely, and others drop into a state of lethargy, because there is no one to determine their usefulness, and, if necessary, demonstrate their practical money value. To do this, just such an institution as the Electrical Development and Manufacturing Company is necessary. There are also many stray inventions lying about, dust soiled and wrinkled, which have little real value in themselves, but by combining them with others a completed system can be constructed that will be advantageous to the inventors and profitable to the company. Every day we learn from some inventor something new about electricity and its possibilities, but the want of means to experiment and develop his ideas into practical facts prevents him from producing what might exceed in usefulness many yet discovered. This opportunity the company propose to offer to inventors and assist them to carry forward their plans.

No more worthy object than that outlined by the company has come to our notice for some time past, and we believe the success of the venture is assured from the outset. That it can be made to pay investors is unquestioned. A glance at the United States Patent Office *Gazette*, freighted as it is each week with the successful efforts of many, and then over the electrical field wherein there is so much yet to be discovered and put into practical commercial use, will dissipate all doubt upon that subject. That it will assist the inventor is beyond all possible doubt, for it will furnish him not only with a market for his inventions, but in extreme cases the means to develop his ideas into something marketable.

The company have secured the services of Col. Charles F. Wood as president and general manager. In taking this step it has shown a desire to succeed, for no man of prominence in electrical circles in the East bears the reputation for honesty of purpose, coupled with the technical knowledge, necessary to make the project successful.

Volga, Dak., January 3, 1884.

Editor Electrical Review:

Will you please answer the following questions in your journal? In a description of Mr. Delany's synchronous multiplex telegraphy, in No. 16 of the REVIEW, it is said that the battery is split What does that mean? What is the use of M. Trouvé's polyscope? If it would not take up too much time and space, would you please give me an idea of its construction?

Yours, respectfully, N. K.

ANSWER.

Mr. Delany's synchronous multiplex system of telegraphy will be found fully described elsewhere, in this edition.—ED.

Injuries Caused by Electricity.

1. Injuries caused by electricity were formerly confined to cases where persons were struck by lightning

2. They are now made numerous by the frequency with which absent-minded people shake hands with dynamos or grasp the wires of electric lights.

3. Lightning occasionally strikes a man "below the belt." It is useless, however, to appeal to the "Marquis of Queensbury Rules" in such a case.

4. If "Jersey lightning" strikes a man, he generally suffers partial paralysis of his lower limbs.

5. Should two electric-light wires lie exposed on the sidewalk, never attempt to put out the light by stepping on them.

6. In case a man should climb an electric-light pole and seize one carbon in each hand, he would be subjected to the action of the electric currents. These are almost as fatal in their effects as green currants.

7. According to Sunday-school literature, four-fifths of the people who are killed by lightning are struck while out gunning on Sunday.

8. When hunting on the Sabbath, always use a bow and arrow, or a lasso, so as to avoid attracting the electric fluid.

9. When a man is struck by lightning, he is usually exceedingly shocked at its behavior. H. L. S.

The electric lighting company of Taunton, Mass., has declared a dividend of 2 per cent., 8 per cent. for the year.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JANUARY 29, 1884.

292,469 Secondary battery element: Willard E. Case, Auburn, N. Y.

292,529 Electrical traction motor; William E. Ayrton and John Perry, London, England.

292,539 Electric conductor; Alfred A. Cowles, New York, N. Y., assignor to the Ansonia Brass and Copper Company, Ansonia, Conn.

292,542 Electric signaling apparatus: Lewis John Crossley and Walter Emmott, Halifax, and John Frederick Harrison, Bradford, County of York, England.

292,586 Electrical circuit-breaker for annunciators and gas-lighting apparatus; Thos. H. Rhodes, Brooklyn, N. Y.

292,602 Telephone receiver; Henry E. Waite, New York, N. Y., assignor to the Molecular Telephone Company; same place.

292,603 Telephone transmitter; Henry E. Waite, New York, N. Y., assignor to the Molecular Telephone Company; same place.

292,624 Autographic telegraph; Michael Hoffman Wilson, Brooklyn, N. Y., assignor of one fourth to Clara Louise Wilson, same place, and Henry McCobb, New York, N. Y.

292,625 Dynamo-electric machine; William F. Buckley, Cleveland, O.

292,691 Dynamo-electric machine; John S. Sellon, Hatton Garden, County of Middlesex, England.

292,694 Insulated conductor of electricity; Wm. Anthony Shaw, Pittsburgh, Pa., assignor of one-half to Lebbeus H. Rogers, New York, N. Y.

292,713 Fusible safety strip for electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, of New York, N. Y.

292,714 Electrical indicator; Edward Weston, N. J., assignor to the United States Electric-Lighting Company, of New York, N. Y.

292,715 Regulator for dynamo-electric machines; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,716 Device for connecting safety strips in electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Co., New York, N. Y.

292,717 Conductor for electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,718 Electric circuit; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,719 Electrical generator, or motor; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,720 Incandescent lamp; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,721 System for the electrical transmission of power; Edward Weston, Newark, N. J., assignor to the United States Electric-Lighting Company, New York, N. Y.

292,743 Interlocking switch apparatus; Oscar Gassett, Boston, Mass., assignor to the Union Switch and Signal Company, Pittsburgh, Pa.

292,744 Electric-signaling apparatus for railway crossings; Oscar Gassett, Boston, Mass., assignor to the Union Switch and Signal Company, Pittsburgh, Pa.

292,761 Alarm for electric lamps; Joseph Olmstead, New York, N. Y., assignor to the Olmstead Electric Light and Power Company, same place.

292,762 Electric accumulator; Gustave Phillippart, Paris, France.

292,770 Manufacturing a rot-proof covering for underground telegraph cables; P. H. Vander Weyde, New York, N. Y.

292,772 Compound electric cable; Henry Van Hoevenbergh, Elizabeth, N. J., assignor to Richard S. Waring, Pittsburgh, Pa.

Average Market Quotations of Battery Supplies for the Week Ending February 7, 1884.

Disque Leclanche Battery, per cell		90c.
" "	Porous Cups	75c.
" "	Jars	25c
Prism Leclanche Battery, per cell		$1.25c.
" "	Prisms, per pair	90c.
" "	Carbons	30c.
" "	Jars	25c.
" "	Jar cover	12c.
Leclanche zincs		12c.
Crow foot, 6x8, per cell		75c.
Callaud Zincs		30c.
" Coppers		18c.
" Jars		25c.
Sal Ammoniac, per lb		12½c.
Blue vitriol, per lb		6½c.
" " bbl., lots, per lb		5½c.
Sulphate of zinc		10c.
Battery syringe		$1.90c.
Battery brush		20c.
Hydrometer		50c.

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Average Telephone Stock Quotations, for week ending February 7th, 1884.

	Highest.	Lowest.
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Central New York Telephone and Telegraph Company	100	92
Empire State Telephone and Telegraph Company	198	185
Hudson River Telephone and Telegraph Company	100	89
New York and New Jersey Telephone Company	86	81
Mexican Telephone Company	2½	2¼
New York and Pennsylvania Telephone Company	70	67
Southern Bell Telephone and Telegraph Company	125	120
Tropical Telephone Company	2¼	2⅛
Central Union Telephone Co.	100	95
Iowa Union " "	91	89
Missouri and Kansas Telephone Co.	98	90
United Telephone Co. (Kansas and Missouri)	97	95
Bell Telephone Company, of Missouri	160	152
Wisconsin Telephone Company	120	115
Cumberland Telephone Co.	100	97
Great Southern Telephone Co.	100	95
Michigan Telephone Company	105	100
Chicago Telephone Company	282	280
Erie Telephone Company	39	35
Union Telephone Company	100	95
Southern New England Telephone Company	165	160
New England Telephone Co.	53	45
Chesapeake & Potomac Telephone Co.	100	97

The Daft Electric Light and Power Company have a plant in operation at 32 Spruce Street, this city. The present installation is not large, but will doubtless determine the economy in running elevators and light machinery by electricity.

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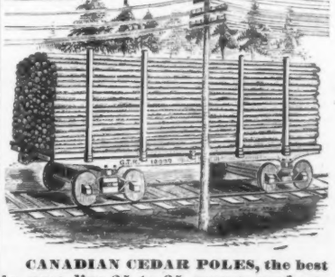

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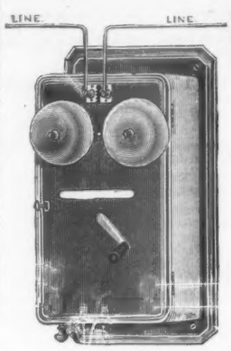

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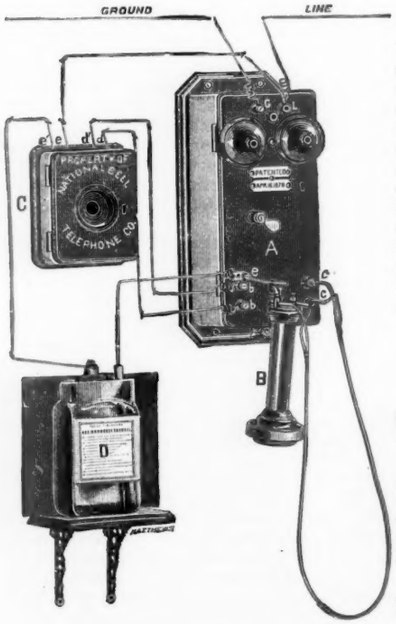

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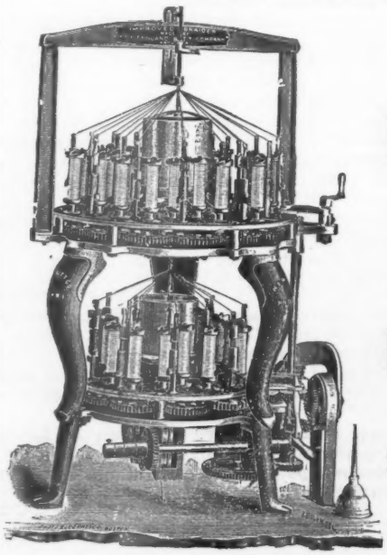

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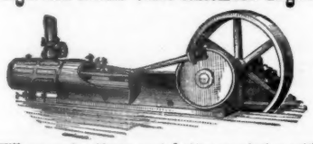

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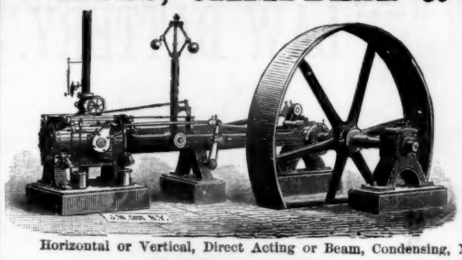

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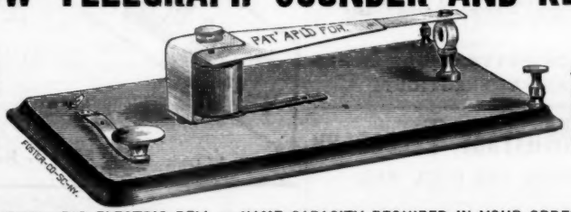

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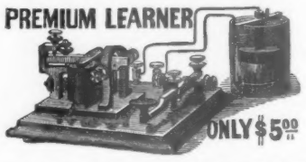

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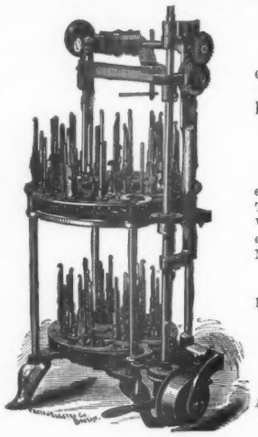

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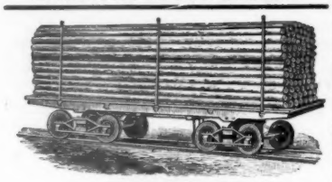

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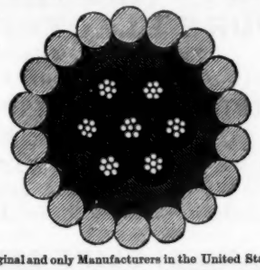

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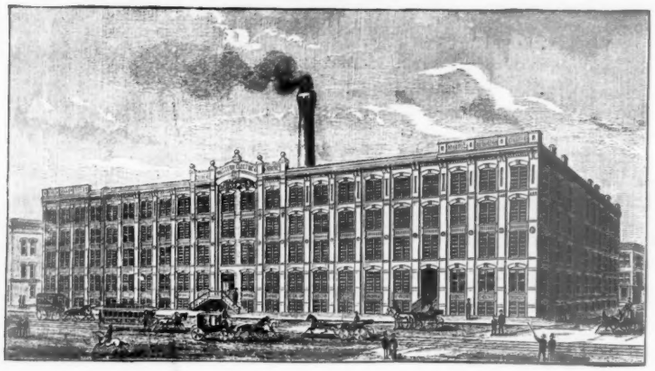

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